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OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

American Dyestuff Reporter was founded in 1917 and the Textile Colorist and Converter (formerly Textile Colorist) was incorporated with it in January, 1949. Published every other Monday by the HOWES PUBLISHING COMPANY, INC., 44 E. 23rd Street, New York 10, N. Y. C. R. Howes, President; Ernest J. Finan, Executive Vice-President; Norman A. Johnson, Vice-President & Treasurer; Myron D. Reeser, Vice-President; C. Essenbreis, Secretary.

Telephone SPring 7-9364

AMERICAN

DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING • DYEING • PRINTING • FINISHING

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Proceedings of the

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

NOVEMBER 22, 1954

AATCC CALENDAR

(A general calendar of events may be found on page 800)

COUNCIL
Jan 21 (Hotel Statler, New York), Apr 15, June 17.

NATIONAL CONVENTIONS
Sept 22-25, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J; 1956 (Waldorf-Astoria, New York); 1957 (Boston).

HUDSON-MOHAWK SECTION
Dec 2, Jan 14, Feb 25, April 15 (Albany, N Y); May 20 (Ladies Night); June 24 (Annual Outing).

NEW YORK SECTION
January 28 (Georgian Room, Hotel Statler, New York); February 25 (Skytop, Hotel Statler, New York); March 18, April 22, May 20 (Kohler's Swiss Chalet, Rochelle Park, N J).

NORTHERN NEW ENGLAND SECTION
Dec 10 (Woodland Golf Club, Auburndale, Mass).

PACIFIC SOUTHWEST SECTION
Dec 3 (Gourmet Restaurant, Beverly Hills, Calif).

PHILADELPHIA SECTION
Dec 3 (Kugler's Restaurant, Philadelphia).

RHODE ISLAND SECTION
Dec 2 (Annual Meeting—Sheraton Biltmore, Providence, R I).

SOUTH CENTRAL SECTION
Dec 4 (Hotel Patten, Chattanooga).

SOUTHEASTERN SECTION
Dec 11 (Atlanta-Biltmore, Atlanta, Ga).

WASHINGTON SECTION
Dec 8 (Pepco Auditorium, Washington); Feb 11 (Washington); May 20.

WESTERN NEW ENGLAND SECTION
Dec 10 (Rapp's Restaurant, Shelton, Conn).

WESTERN NEW YORK SECTION
Nov 27 (Hamilton, Ont); Jan 14 (Buffalo); Mar 4 (Hamilton, Ont); April 22 (Buffalo); June 24 (Outing).

NOTICE

AATCC Research Newsletter #18, originally scheduled for this issue, is being held over until December 6th so as to cover the Research Committee meetings of November 18-19 in New York.

Ben Verity

BEN VERITY, a charter member of AATCC and past chairman of the Rhode Island Section, died on October 20th at the age of 83.

Mr Verity was born in Yorkshire, England on Jan 14, 1871, and attended Yorkshire College (now Leeds University). He began his industry career with the Walpole Dye and Chemical Company in England, but left that country in 1889 at the age of 18 to join the Magog Print Works of Canada, part of the Dominion Textile Co. In 1911 he joined the American Print Co, Fall River, Mass, where he worked until 1935, at which time he joined Carbic Color and Chemical Co. Mr Verity remained with Carbic until his retirement in 1951. He spent his last years at his home at Chatham, Mass.

In addition to his membership in AATCC, which he served nationally as a member of the research committee, Mr Verity had been a member of the (British) Society of Dyers and Colourists for fifty years. He also belonged to the American Chemical Society.

On the occasion of his retirement, Mr Verity was tendered a dinner, sponsored by Carbic, and attended by a representative group of his countless friends in the industry. Commenting editorially on the event, the *Royce Reporter* of June, 1951, appropriately carried the following lines:

"Good Old Ben"

"The above expression was probably heard more than any other at a dinner tendered by the Carbic Color Company to the friends of Ven Verity, their technical representative for many years, on the occasion of his retirement, at the ripe age of eighty years.

"Some one has widely said 'Youth is not a time of life—it's a state of mind. Nobody grows old merely by living a number of years. People grow old by deserting their ideals. Years wrinkle the skin, but to give up enthusiasm wrinkles the soul.'

"The years have been very kind to Ben. To most of us, he still looks as he did 25 and more years ago. And it is certain that his soul is free from wrinkles. He still retains that boyish enthusiasm, which has been characteristic of him throughout his active life."

Third Prize Winner
1954 Intersectional Contest——

AN INVESTIGATION OF THE PROPERTIES OF CYANOETHYLATED COTTON*

RHODE ISLAND SECTION

COMMITTEE
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The production of cyanoethylated cotton by the action of acrylonitrile on cotton cellulose has been well described by Compton, Buck, and others, and a considerable amount of data has already been compiled on the physicial and chemical properties of the new fiber, temporarily named "T-7."

The object of this investigation was to study the effect on T-7 of various bleaching dyeing, printing and finishing operations normally employed on cotton, and in particular, to measure the stability of the -CN groups when subjected to various chemical treatments.

The affinity of the new fiber for the different classes of dyes was determined, and the fastness of the resultant dyeings to light, washing, etc, was compared with that on cotton. The resistance of T-7 to micro-organisms was also studied.

INTRODUCTION

THE process of cyanoethylation of cotton fibers by reaction with acrylonitrile, as developed at the Institute of Technology, has been described well by Compton and others (*1, 2, 3*). While this particular application of acrylonitrile to cotton is relatively new, considerable work has been published on the reaction of acrylonitrile with cellulose and other high polymers containing hydroxyl or other active-hydrogen groups. Bruson (*4, 5*) characterized the basic reactions of acrylonitrile including reactions with polymeric substances. Bock and Houk (*6, 7*) reacted cotton fibers with acrylonitrile in the presence of caustic alkalis or quaternary ammonium bases, and obtained a range of substituted celluloses, including cyanoethylated cellulose and carboxyethyl cellulose. A very critical study of the preparation and properties of cyanoethylated celluloses fibers was made by MacGregor and Pugh (*8,9*), who not only characterized the different cyanoethylated celluloses obtained under different experimental conditions, but also studied their physical, chemical, mechanical, and dyeing properties.

Compton (*1*) reported that partially cyanoethylated cotton fibers (temporarily designated as "T-7") are similar in appearance, hand, and processing characteristics to cotton, but differ primarily in that they are a) permanently resistant to micro-organism attack, such as mildew and bacteria, b) more resistant to wet and dry heat degradation, c) more receptive to all classes of dyes, including acid dyes, and d) more resistant to abrasion.

It is apparent from this statement that the action of acrylonitrile definitely improves the properties of basic cotton in certain particulars. However, the cost of the process (not yet officially announced, but probably considerable because of chemical and manufacturing factors) should be taken into consideration.

Since, in the final analysis, properties are weighed against cost, it becomes apparent that the degree to which these reported improvements have been achieved will determine the acceptance of these new fibers in the trade.

The Committee decided to obtain additional informatiton on the properties of T-7 by comparing it with untreated cotton in a variety of tests, including the action of bleaching agents; the affinity for dyes of all types (with emphasis on penetration); absorbency; water repellency; fastness to light, washing, and crocking of dyeings; possible hydrolysis of the CN groups as the result of the various chemical treatments encountered in processing; and the resistance to micro-organisms, as determined by soil-burial tests.

CHEMISTRY OF CYANOETHYLATION

The process of cyanoethylating cellulose either in solution or in fiber form consists essentially of reacting acrylonitrile with —OH groups in the cellulose in the presence of strong alkaline catalysts:

$$\text{Cell—OH} + \text{CH}_2\text{CHCN} \rightarrow$$
$$\text{Cell—O—CH}_2\text{ CH}_2\text{ CN}$$

The degree of substitution can be controlled, depending on the concentration of the alkali and the time and temperature of the reaction (*1*).

The properties of the cyanoethylated cellulose reportedly vary in accordance with the number of acrylonitrile units substituted (*1, 8*). Moreover, under all reaction conditions, the reaction of acrylonitrile with cellulose is competitive with other side reactions that can occur. The most notable of these is the hydrolysis of the CN group to the carboxylate. One of the basic properties of organic compounds containing nitrile or cyano groups is that such groups can be readily hydrolyzed by acids and alkalis to give the corresponding carboxylic acid or its salt:

$$\text{R.CN} + \text{NaOH} + \text{H}_2\text{O} = \text{R.COONa} + \text{NH}_3$$
$$\text{R.CN} + \text{HCl} + 2\text{H}_2\text{O} = \text{R.COOH} + \text{NH}_4\text{Cl}$$

Since some of the desirable properties of T-7 cyanoethylated cotton are directly related to the cyanoethyl group, it was considered important to study the hydrolysis which might take place under acid or alkaline processing, such as scouring, bleaching, and dyeing. MacGregor (*8*) already has discussed the hydrolysis of cyanoethylated cellulose and shown that, under strongly alkaline conditions, the cyanoethyl group was converted into the

* Presented by W George Parks at the Atlanta Biltmore Hotel, Atlanta, Georgia, on Sept 18, 1954.

carboxyethyl derivative with the release of nitrogen from the CN group as NH_3. This reaction was used in the Committee's work to determine the degree of hydrolysis of the CN group in the various processing treatments. It is discussed under the section entitled, "Hydrolysis Method for Determining the Nitrogen Content of T-7 Yarn and Fabric."

SOURCE OF MATERIALS

The T-7 materials used in the tests to be described included:

a) about 30 yds of 80x60 cotton cloth, containing approximately 3.54% nitrogen; cyanoethylated in the yarn at Standard-Coosa-Thatcher Co. and woven at the Institute of Textile Technology.

b) four 1-yd pieces of 80x80 cotton cloth, containing 1.8%, 2.9%, 4.5%, and 6.5% nitrogen respectively; bleached and cyanoethylated in the piece at ITT.

c) cotton yarn, containing 3.1% nitrogen; cyanoethylated at Standard-Coosa-Thatcher.

Wherever possible, duplicate tests were run with untreated cotton material of approximately the same construction.

SCOURING AND BLEACHING OF T-7———The cyanoethylated yarn or fabric as received in the greige had very poor absorbency. Since the cotton was given a caustic boil-off prior to cyanoethylation, and the T-7 warp yarn used, being plied yarn, required no sizing (*11*), the poor absorbency was probably due to the acrylonitrile treatment itself. To increase the absorbency of the material, preliminary tests were carried out on T-7 yarn, which was reported to contain 3.1% nitrogen, as follows (percentages based on volume of bath):

No.		*Nitrogen retained (%)*
1	2% sodium hydroxide 0.25% nonionic detergent	1.05
2	0.5% anionic detergent 0.125% tetrasodium pyrophosphate	2.88
3	1.5% nonionic detergent	2.97

All skeins were treated for 1 hour at 190-200°F. The yarn:liquor ratio was 1:40. The absorbency was excellent in all cases.

Based on the nitrogen content of the scoured yarn, it was evident that a neutral scour would be necessary if hydrolysis were to be avoided.

Although the neutral scour (treatment #3 above) had improved the absorbency, the T-7 yarn still required bleaching if it was to be dyed a pastel shade of acceptable brightness. Skeins of the yarn containing 3.1% nitrogen were therefore bleached in a variety of ways, as follows:

No.		*Nitrogen retained (%)*
1	0.5% hydrogen peroxide (100% H_2O_2) 0.25% sodium silicate 0.125% nonionic detergent	2.93
2	0.5% hydrogen peroxide (100% H_2O_2) 0.25% borax 0.125% nonionic detergent	3.14
3	0.5% hydrogen peroxide (100% H_2O_2) 0.125% nonionic detergent ammonium hydroxide (added gradually during bleaching to maintain pH 7.5-8.0)	3.13
4	0.25% Textone (sodium chlorite) 0.5% acetic acid, glacial 0.125% nonionic detergent	3.11
5	10.0% sodium hypochlorite, containing 25 gpl available chlorine 0.33% nonionic detergent	
6	10.0% hydrogen peroxide (30 vol) 0.5% sodium hydroxide 1-N 0.33% nonionic detergent	

Bleaches #1 to #4 were carried out for 1 hour at 190-200°F. Bleaches #5 and #6 were conducted for 24 hours at 70-80°F. All samples were rinsed hot and cold and dried. The yarn:liquor ratio was 1:40.

It was decided that #5 and #6 did not merit further consideration because they did not produce satisfactory whites. Although #3 gave a good white, it would be impossible to control the alkalinity under plant conditions. #1 was eliminated because of greater loss of nitrogen due to hydrolysis by the silicate. #2 and #4 were considered satisfactory.

A modified Draves wetting test was made on the several bleached skeins. #1 to #4 wet out instantly; #5 and #6 showed poor absorbency.

Following these results, Bleaches #2 and #4, slightly modified, were repeated on 80x60 T-7 fabric containing 3.54% nitrogen as follows:

No.		*Nitrogen retained (%)*
1	0.5% hydrogen peroxide (100% H_2O_2) 0.25% borax 0.25% nonionic detergent 15 minutes at 190-209° F	3.35
2	0.25% Textone (sodium chlorite) 0.5% acetic acid 56% 0.25% nonionic detergent 15 minutes at 150° F	3.50

The absorbency in both cases was reasonably good. The whiteness of the peroxide bleach was satisfactory; that of the Textone bleach was acceptable but not as good as the other.

To determine possible effects of the bleaching on the dyeing properties of T-7, dyeings were made with three dyes (1 direct, 1 vat, and 1 metallized-basic dye) on the peroxide-bleached, Textone-bleached, and unbleached material. No appreciable differences were observed.

THE EFFECT OF T-7 ON DYES

Comparative dyeing tests were made on T-7 fabric (nitrogen content, 3.54%) and untreated cotton cloth of approximately the same construction, using representative dyes of all the regular classifications. (In a few cases T-7 yarn, containing 3.1% nitrogen, and untreated cotton yarn were used instead of fabric.) In addition, print tests were made with representative dyes of the various printing classifications. The results of these dyeing and printing tests[1] are summarized on page P776, together with data on fastness to light, washing, and crocking in some cases. It should be noted that the shade on T-7 frequently was quite different from that made with the same dye on cotton.

[1] Complete details of these tests, with the names of the dyes, are not included in this paper, but they are available on request.

TABLE I

COMPARATIVE DYE AFFINITIES OF T-7 AND OTHER FIBERS

Dye	*Type*	*T-7*	*Wool*	*Cotton*	*Silk*	*Viscose*	*Acetate*	*Nylon*	*Dacron*	*Orlon*
Supra Red L4BL	direct	x	y	x	z	xx	o	o	o	o
Supra Blue RL	direct	x	y	x	z	xx	o	o	o	o
Brill Red 3B	acid	y	xx	z	y	o	o	x	o	o
Orange RL	metallized acid	x	x	z	x	o	z	xx	o	o
Red 6B	metallized basic	y	x	z	xx	z	x	x	o	x
Red Salt GL & Naphthol AS		x	x	x	x	x	y	o	o	o
Scarlet Salt R & Naphthol ASSW		x	x	x	x	x	z	o	o	o
Red HB Dbl	anthraquinone vat	x	y	x	z	xx	xx	z	o	o
Pink IR Pdr (Pr 109)	leuco ester	x	y	z	x	z	o	o	o	o
Fast Blue B-FGL	azo disperse	x	x	z	xx	z	xx	xx	y	z
Blue FFRN Conc (Pr 228)	anthraquinone disperse	x	x	z	x	z	xx	xx	y	z

LEGEND: x — reasonably full shade
xx — very full shade
y — less than one-half as full as x
z — only tinted
o — left practically white

DYEING TESTS

Direct (5 dyes). In 4 cases, the dyeings were of equal depth; in one case, the T-7 dyeing was slightly weaker. Fastness to washing: little difference. Fastness to light: 3 dyes faded more on T-7. Fastness to crocking: all about equal.

Vat (5 dyes). With the reduced method, T-7 dyed somewhat heavier in all cases; dyed by the pigment-pad method, there was little difference in depth. Two dyes faded more on T-7; the others were about equal.

Sulfur (1 dye). T-7 dyed heavier, but the dye faded more. Fastness to washing: equal.

Disperse (acetate) (2 dyes). T-7 dyed much heavier (as was to be expected due to the CN groups), but the fastness to washing was not good.

Basic (2 dyes). T-7 dyed much heavier, requiring no mordant, but the fastness to washing was poor.

Acid (5 dyes). Four of the dyes were much heavier on T-7, but the fastness to washing was poor.

Azoic (2 dyeings on Naphthol prepare). T-7 dyed heavier in both cases. The fastness to crocking was decidedly worse on T-7.

Leuco Ester (1 dye). T-7 dyed much fuller; fastness about equal.

PRINTING TESTS

Direct (3 dyes). Very little difference between T-7 and untreated cotton in shade and fastness to washing and crocking. Fastness to light on T-7 was distinctly worse in one case.

Vat (6 dyes). All about equal in all respects, including fastness.

Mordant (2 dyes). Both about equal in shade and fastness to light and crocking. T-7 was somewhat inferior in fastness to washing.

Sulfur (2 dyes). About equal in all respects.

Basic (2 dyes). About equal in all respects.

Leuco Ester (2 dyes). About equal in fastness; shade somewhat lighter on T-7.

Rapidogen (2 dyes). Shade considerably lighter on T-7 in one case. Fastness to light on T-7 inferior in both cases. Otherwise equal.

Naphthol (2 combinations). Shade on T-7 somewhat lighter; fastness to crocking worse. Otherwise equal.

Pigment (4 resin-bonded pigments in water-in-oil emulsions and 4 in oil-in-water emulsions). All practically equal on both fibers in shade and fastness to washing and crocking.

The conclusions which may be drawn from these dyeing and printing tests may be summarized as follows:

So far as direct, vat, sulfur, mordant, basic, azoic, leuco ester, and pigment dyes are concerned (i e, dyes applied to untreated cotton by conventional methods in dyeing and printing), the T-7 fiber with nitrogen content of 3.54% appears to have no marked advantages, as regards shade, depth, and fastness, to compensate for the expense of the acrylonitrile treatment; in addition, there appears to be a tendency towards poorer lightfastness in many cases. However, where immunity to attack by micro-organisms and improved heat resistance (*1*) are important requirements in a fabric, it would appear that T-7 merits consideration. *A word of caution is necessary here:* the permanence of the cyanoethylation treatment lasts only as long as the CN groups are not hydrolyzed.

As regards those dyes which do not normally dye cotton but do dye T-7 (e g, acid and disperse dyes), it is suggested that there might be an opening here for dyeing unions of T-7 and some of the synthetic fibers; for example, combinations of T-7 and acetate dyed with disperse dyes, or combinations of T-7 and nylon dyed with acid dyes. These possibilities are discussed further in subsequent paragraphs.

DYEING T-7 BY THE CUPROUS-ION PROCESS ——— The presence of CN groups in the molecule of T-7 suggests that it might be dyed (like Orlon, Acrilan, etc, which have similar groups) by the cuprous-ion process. Several acid dyes, which are used successfully on Orlon by this process, were applied to T-7 with and without the cuprous ions. In each case the dyeing with the cuprous ions was much fuller. The wash-fastness of these dyeings, using the AATCC #3 test (*14*), was poor, however.

THE EFFECT OF DIFFERENT DEGREES OF CYANOETHYLATION ON THE AFFINITY OF T-7 FOR DYES ———Compton (*2*) states that cyanoethylated cotton fibers have "increased receptivity to all classes of dyes, including acid dyes," and he presents a table showing the large saving in the amount of dyes, particularly direct, vat, and sulfur, made possible by the use of cyanoethylation. It should be pointed out that his tests were made with fibers containing only 1.5% nitrogen, while the dyeings and prints already referred to in this paper were all made on fibers containing over 3% nitrogen. It has been reported by others (*11*) that 1.5% nitrogen is the optimum amount for dyeing purposes, and that as the nitrogen content is increased, the affinity for dyes normally used on cotton is progressively reduced. This should explain why the results of the dyeings reported in this paper seem to be in conflict with those reported by Compton.

The effect of different CN contents was well illustrated by tests in which samples of T-7 containing a) 1.8%, b) 2.9%, c) 4.5%, and d) 6.5% nitrogen, also e) untreated cotton were dyed with 0.5% Direct Supra Red 4BL, with 0.5% Disperse Red GG (Pr 236), and with 0.5% Metallized Rhodamine.

With 0.5% Direct Supra Red 4BL. Samples (a) and (b) were a little fuller than (e); (c) was distinctly lighter, and (d) was hardly dyed. Here the affinity is diminished as the nitrogen is increased.

With 0.5% Disperse Red GG. Sample (d) was by far the deepest shade, samples (c), (b), and (a), were progressively lighter, and (e) was only tinted. Here the affinity is increased with higher nitrogen content.

With 0.5% Metallized Rhodamine. Sample (d) was again dyed the deepest shade; (c), (b), and (a) were progressively lighter, and (e) was only a pale pink. This result is similar to that with 0.5% Disperse Red GG.

It perhaps should be pointed out that, while only 1.5% nitrogen in T-7 is the optimum amount for dyeing purposes (to

save dyestuff), it is not sufficient for mildewproofing purposes, since Compton (2) shows that fibers containing as little as 2% nitrogen lose nearly 60% in tensile strength during a 2-week soil-burial test.

TESTS FOR DYE AFFINITY ON MULTIFIBERS———In order that the dye affinity of T-7 might be compared with that of fibers other than cotton, tests were made on the AATCC Multifiber Test Fabric containing stripes of wool, cotton, silk, viscose, acetate, and nylon, to which had been added stripes of T-7, spun Dacron, and spun Orlon.

Results of these tests are shown in Table I.

DYE AFFINITY OF T-7 OF VARIED NITROGEN CONTENT COMPARED WITH ACETATE, NYLON, AND COTTON———Since dyeings made with disperse (acetate) dyes on T-7 showed some promise, it was decided to sew samples of T-7 fabric into rolls of acetate rayon and dye them on the jig. For this purpose the following samples of T-7 were employed:

Sample	
1	cotton cloth (control)
2	T-7 fabric containing 2.5% nitrogen
3	T-7 fabric containing 3.4% nitrogen
4	T-7 fabric containing 6.5% nitrogen (used in one test only)

The rolls were dyed with combinations of disperse dyes to the following shades: red, mint, royal, navy, and maroon. In every case the control sample was practically white, while the T-7 samples were dyed, though considerably lighter than the acetate fabric, sample #3 being somewhat more dyed than #2 in every case. Sample #4, used only in the navy shade, was much deeper than #3 and approached the acetate fabric in shade and depth. Evidently the higher the nitrogen content of T-7, the better the dyeing becomes with disperse dyes, as previously stated.

To test further the affinity of T-7 for acid dyes, samples of fabrics #1, #2, and #3 were also sewed into a roll of nylon, which was dyed a full shade with a milling red. Here the control was only soiled, while the T-7 samples were fully as deeply colored as the nylon; sample #3 was a little deeper than #2. Here again, the higher nitrogen content produced the deeper dyeing.

Samples of the same three fabrics were also sewed into a roll of cotton-lastex cloth, which was dyed with a combination of direct dyes to a full red shade. Here the control sample dyed a little heavier than the roll, while the T-7 samples were lighter, especially sample #3. Here the higher nitrogen content decreased the affinity for direct dyes, confirming previous tests.

So far as can be determined by the few dyes tested, combinations of T-7 and acetate perhaps can be dyed in reasonably solid shades by the use of selected disperse dyes, provided the nitrogen content of the T-7 fibers is sufficiently high (5% or over). It must be added, however, that the fastness of all five shades dyed, both to light and to washing, was much poorer on the T-7 samples than on the acetate rolls.

Combinations of T-7 and nylon dyed in solid shades with selected acid dyes appear to be feasible, and here the nitrogen content can be much lower. It appears unlikely that combinations of T-7 and untreated cotton will be of interest.

It was decided to make one more test, comparing the dyeing properties of T-7 and acetate rayon. Samples of T-7 cloth (containing 3.54% nitrogen), cotton cloth, and an acetate fabric were dyed with two disperse blue dyes (Pr 227 and 229) by the Holliday Pad-Dyeing Process (17). (This process essentially consists of passing the material to be dyed through a pad liquor containing a highly dispersed acetate dye or dyes, selected penetrants, a suitable swelling agent, and a gum; then developing in a jig, box, or other suitable equipment.) The T-7 was dyed to a depth closely approximating the depth obtained on acetate padded through the same dyebath. The cotton control showed only a slight staining under the same conditions. The washfastness (AATCC #1) (14) was much better on the acetate than on the T-7, however. Crocking tests showed little difference.

It is suggested that blends of T-7 and acetate might be dyed with disperse dyes to obtain uniform shades using the Holliday process. Where blends of acetate or other synthetics and ordinary cotton are to be dyed, fast-to-light direct dyes are normally used to dye the cotton. Substitution of T-7 for cotton in these blends might eliminate the necessity for dyeing the cotton with direct dyes. For this purpose, however, there is some doubt as to whether disperse dyes of sufficient fastness can be found for the T-7.

EFFECT OF HYDROLYSIS OF THE CN GROUPS ON THE DYEING OF T-7 WITH BASIC DYES———T-7 fabric was treated with sodium hydroxide 1° Tw for one-half hour at 212°F, rinsed and neutralized, and dyed together with unhydrolyzed fabric, using the following basic colors: Methyl Violet B, Malachite Green, Rhodamine B, Rhodamine B Metallized, and Methylene Blue Zinc-free. In all cases the hydrolyzed fabric showed a marked decrease in depth, indicating that the alkali treatment had destroyed almost completely the CN groups, and therefore the affinity for basic dyes.[2]

EFFECT OF UREA-FORMALDEHYDE RESIN ON LIGHTFASTNESS——— Samples of T-7 and untreated cotton cloth were dyed with 3% Direct Green BLL (Pr 425), and one-half of each dyeing was aftertreated with urea-formaldehyde using the usual anticrease technique. All four samples were then exposed to light in the Fade-Ometer.

The unresinated dyeings did not fade appreciably in 40 hours. The resinated dyeings, after only 4 hours, showed a slight fading on untreated cotton and a very marked fading on T-7.

GAS FADING———Since T-7, like acetate rayon, can be dyed readily with disperse (acetate) dyes, it was desired to ascertain whether the dyes that show gas fading on acetate (i e, from the fumes from lighted gas burners) would have the same effect on T-7.

A dyeing was made on T-7 fabric (nitrogen content 3.54%) with a disperse blue (Pr 228) known to be extremely sensitive to gas fumes. The dyeing was exposed in a gas chamber, using the regular AATCC technique (12), in comparison with a piece of the AATCC Control Sample #1. The latter was badly faded after one cycle of exposure; the T-7 dyeing was somewhat redder and duller.

FINISHING

WATER REPELLENCY———Samples of T-7 fabric (nitrogen content 3.54%) and untreated cotton cloth, both scoured with a nonionic detergent, were padded with Permel resin, 12 oz/gal, and also with a silicone-type water-repellent. The samples were dried at 225°F and cured for 3 minutes, the Permel finish at 300°F and the silicone-type finish at 370°F. They were then given the AATCC Spray Test (15). The two finishes gave good spray ratings on both fabrics, the T-7 samples being slightly better than the control.

RESIN FINISHES——— Plant trials were run on T-7 fabric (nitrogen content 3.54%) and untreated cotton cloth, using the following finishes:

#1. (For crease-resistance only)
8.0% substituted urea-formaldehyde resin
1.0% urea-formaldehyde condensate
0.5% polyvinyl alcohol
1.5% substantive softener
1.0% organic catalyst
Padded, dried, cured at 320° F, soaped and dried.

[2] It would be interesting to know exactly what changes take place in the cyanoethyl groups when hydrolyzed with caustic alkali; ie, whether CN is converted to COONa, or whether some other reaction takes place. This, however, is outside of the scope of this paper.

#2. (For water-repellency and crease-resistance)
6.0% melamine-formaldehyde resin
5.0% urea-formaldehyde condensate
5.0% silicone-type water-repellent
1.7% water-repellent catalyst
1.0% organic catalyst
Padded, dried, cured at 365° F, washed with ammonia, and dried.

Samples of all four fabrics were tested for crease-recovery on the Monsanto Wrinkle Recovery Tester (*16*), and two of them for water-repellency (*15*). No appreciable differences between T-7 and the control were found.

Although the hand of the T-7 fabric before finishing was slightly firmer and heavier than the control, there was very little difference after application of the water-repellent crease-resistant finish (#2); but the plain crease-resistant finish (#1) caused the T-7 fabric to feel somewhat harsher and more bulky than the control.

The usual drop in tensile strength was observed on all four fabrics; if anything, the T-7 fabric showed a smaller loss in strength than the control in both cases.

HEBERLEIN FINISH———It was desired to determine whether the Heberlein finish, when applied to cyanoethylated cotton cloth, would produce hydrolysis of the CN groups, since it involves treatment with strong acid and alkaline solutions.

A piece of lawn was sent to the Institute of Textile Technology to be cyanoethylated, after which it was passed through the Heberlein process in a local finishing plant. The nitrogen content, initially 3.40%, dropped to 2.26% after the Heberlein treatment, indicating that considerable hydrolysis had taken place.

CYANOETHYLATION OF DYED COTTON

In order to determine the practicability of cyanoethylating cotton already dyed or printed so as to give it mildew resistance, four large samples of cotton fabric, two dyed and two printed, all with vat dyes, were sent to the Institute of Textile Technology, where they were given the regular cyanoethylation treatment.

An examination of these samples showed that all of the dyes used were partially stripped by the acrylonitrile treatment, and the white ground in the prints was badly stained.

MILDEW RESISTANCE OF VAT-DYED T-7 FABRIC

It was reported by Compton (*1*) that cyanoethylated cotton would withstand a 14-day soil-burial test. There was no information given concerning the effect of dyeing or finishing of these materials before making the burial test.

To establish the practical value of T-7 as possible material for Government or civilian use, a soil-burial test was performed on 80x60 fabric dyed O D #7 shade with vat colors.

Appropriate samples of the T-7 fabric and untreated cotton cloth were prepared for dyeing by scouring for 30 minutes at 170°F in a bath containing an anionic rewetting agent. The samples were dried and padded with the following dyes:

4 oz Vat Khaki 2G (Pr 122)
6 oz Vat Olive R (CI 1150)
1.25 oz Vat Olive Green 2BL (Pr 293)
1 gal water

After being padded, the samples were reduced in separate baths containing 1oz/gal sodium hydrosulfite and 1 oz/gal sodium hydroxide for 45 minutes at 140°F. After being dyed, the samples were rinsed, oxidized with chrome and acetic acid, rinsed again, and soaped. It was noted that the T-7 dyed slightly heavier in shade than the cotton sample.

The dyed samples, two each of T-7 and cotton, were then subjected to a soil-burial test (*18*) at the University of Rhode Island. After 14 days the cotton samples were completely destroyed, while the strength of the T-7 samples was unaffected. Thus it is concluded that T-7 fabric can be vat-dyed without losing the valuable property of mildew resistance.

BREAKING STRENGTH (LBS)

Natural Control (dyed)
As received.....64.5
Buried 14 days.....0
Cotton Control (Dyed)
As received.....65.0
Buried 14 days.....0
Cyanoethylated Cotton (dyed)—Sample #1
As received.....64.5
Buried 14 days...65.5
Cyanoethylated Cotton (dyed)—Sample #2
As received.....65.5
Buried 14 days...64.0

Even though the vat-dyed T-7 fabrics had good mildew resistance, it was expected that the nitrile (CN) groups present would be partially hydrolyzed during dyeing, with a consequent loss of nitrogen. The nitrogen content of the vat-dyed T-7, before and after burial, was determined by hydrolyzing the CN groups. Vat-dyed untreated cotton samples were also hydrolyzed in the same manner, to ascertain whether or not the dyestuff would liberate any ammonia under the conditions of the analysis. The results of these analyses:

T-7 Undyed
Average of 3 analyses—3.456% nitrogen
T-7 Vat-Dyed
Sample #1—3.072% nitrogen
Sample #2—3.047% nitrogen
T-7 Vat-Dyed and Buried 14 Days
Sample #1—3.298% nitrogen
Sample #2—3.132% nitrogen
Untreated Cotton Vat-Dyed
Sample #3—0.0366% nitrogen
Sample #4—0.0296% nitrogen

During dyeing, the hydrolysis of T-7, which is indicated by the loss of nitrogen, may possibly have resulted in the formation of the sodium salt of carboxyethyl cellulose. Assuming that this is the end product, the resultant T-7 material should be only slightly less mildew resistant (*19*). The slight increase in nitrogen content of the buried samples may possibly be attributed to the decomposition of the unsubstituted anhydroglucose units by micro-organisms. As there is a loss in total weight of the fabric, the nitrogen content should exhibit a corresponding increase percentagewise.

WATER ABSORPTION OF T-7——— Throughout this investigation it was noted that the T-7 fiber was very difficult to wet out. Tests were made, therefore, to check the water absorption properties after prolonged wetting. The standard AATCC Dynamic Absorption Test (*13*) was used. The results given below show that, on prolonged soaking, the T-7 actually absorbs more water than untreated cotton:

Samples	*Water Absorbed* %
Control Cotton Fabric	
A	36.9
B	38.6
T-7 Fabric	
A	43.4
B	42.6

These same samples also were allowed to dry under controlled conditions and were weighed periodically in order that the rate of drying might be studied. A very slightly faster drying rate was noted for the T-7 material.

The higher water absorption or swelling noted for the T-7 material after initial wetting may be responsible for the higher dye absorption noted in some cases.

HYDROLYSIS METHOD FOR DETERMINING THE NITROGEN CONTENT OF T-7 YARN AND FABRIC

It was stated earlier that the CN groups in T-7 can be readily hydrolyzed by acids and alkalis. Since the ordinary processing of textile materials frequently involves the use of acids and alkalis, it was found necessary to make frequent tests on the cyanoethylated material at various stages of the investigation to determine the degree of hydrolysis, if any, which had taken place, by estimating the amount of nitrogen remaining in the material.

It was observed that ammonia was evolved when a skein of T-7 yarn was boiled off in a 2% solution of sodium hydroxide. It was suggested that the hydrolysis of T-7 yarn or fabric could be carried out in a simple distillation apparatus by collecting and titrating the ammonia liberated; in this way the nitrogen content of the T-7 material could be

determined directly, and the acid digestion required in the usual Kjeldahl nitrogen process could be eliminated.

Following this suggestion, the hydrolysis of the nitrile group was carried out in a manner similar to a Kjeldahl distillation, using a flask, spray trap, condenser, and receiver. A sample of T-7 sufficient to give an ammonia equivalent of 25 ml of 0.1*N* acid was weighed into the flask containing 300 ml of water. After the addition of 60 ml of 50% sodium hydroxide to the flask, the simultaneous hydrolysis of T-7 and distillation of ammonia was carried out for one hour at the boil. The ammonia distilled was collected in a known volume of 0.1*N* hydrochloric acid. The acid solution was titrated with 0.1*N* sodium hydroxide, using methyl red indicator. The distillation was repeated in the same manner for one-half hour. A third distillation was run as a check for completeness of reaction. The nitrogen content of the T-7 material was then calculated.

For an 80 x 60 sample of T-7 (calculated 3.54% N), a Macro-Kjeldahl determination showed 3.51% N as compared with 3.45% N calculated from this simplified procedure.

This analytical method is offered as a fairly rapid means of ascertaining the nitrogen content of T-7 material. This procedure was used in establishing the best conditions for bleaching 80 x 60 T-7 fabric, studying the effect of the Heberlein finish on T-7, and determining the nitrogen loss during the application of vat dyes on T-7. So far as is known, details of this simplified method have not yet been published, but it has been learned *(11)* that it is now being used at the Southern Regional Research Laboratory, New Orleans, La.

It is suggested also that the progressive increase in affinity for disperse (acetate) dyes resulting from an increase in the CN content of T-7 might possibly be used as a rough quantitative test for the degree of cyanoethylation of the fiber.

CONCLUSION

The features of T-7 that are most likely to interest the dyer and finisher are:

1) A reasonably good white obtained by bleaching.

2) An increased affinity for certain cotton dyes (direct dyes in particular), reaching a maximum when the nitrogen content is 1.5-2% but falling off progressively as the nitrogen content is increased.

3) A newly acquired affinity for other dyes (disperse, basic, acid), suggesting the possibility of useful blends with other fibers.

4) Resistance to micro-organisms, increasing as the nitrogen content is increased. (This is the case even when the fibers are vat dyed).

Offsetting these advantages are the following disadvantages:

1) The cyanoethylation process is relatively expensive.

2) It has a tendency to reduce the lightfastness of dyes.

3) Dyeings made with disperse, basic, and acid dyes lack washfastness.

4) The CN groups are subject to hydrolysis.

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ACKNOWLEDGMENTS

American Cyanamid Co
Apponaug Co
Arnold, Hoffman & Co, Inc
Bradford Dyeing Assoc (U S A)
Carbic Color & Chemical Co, Inc
Ciba Co, Inc
Cranston Print Works Co
Defiance Bleachery
E I du Pont de Nemours & Co, Inc
Franklin Process Co
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Greenville Finishing Co, Inc
Hilton-Davis Chemical Co
Textile Colors Div, Interchemical Corp
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Monsanto Chemical Co
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MODIFICATION OF UREA-FORMALDEHYDE AND MELAMINE-FORMALDEHYDE CREASE-RESISTANT FINISHES WITH POLYMERIC LATICES*

SOUTHEASTERN SECTION

EDWARD ABRAMS
Southern Research Institute

NEIL H SHERWOOD
B F Goodrich Chemical Co

Polymeric latices, in mixtures with various urea-formaldehyde and melamine-formaldehyde resins, have been applied to cotton chambray to develop a crease-resistant finish with good physical characteristics.

Modification of a urea-formaldehyde formulation with a butadiene-acrylonitrile latex and also with a polyacrylic ester latex in the ratio of 70 parts latex to 30 parts urea-formaldehyde results in a highly crease-resistant fabric. The tearing, breaking, and bursting strengths of these treated fabrics show a marked improvement over these properties in fabrics treated with urea-formaldehyde alone. In addition, the abrasion resistance of fabrics containing latex-modified urea-formaldehyde is excellent. Moreover, the tendency of urea - formaldehyde - treated fabrics to retain chlorine during laundering is markedly reduced.

INTRODUCTION

CELLULOSIC fabrics are noted for their susceptibility to creasing and wrinkling. Thus it is not surprising that a great amount of time and effort has been expended to correct this. To a large extent this has been done by the synthesis of resins within the textile fibers. What to call the improved product has also been a problem. Most often we hear the terms "noncrush," "crush-resistant," "anti-crease," and "crease-resistant" in connection with the intended application of synthetic resins. None of these is completely satisfactory. The new property imparted to cellulosic fibers is a combination of resistance to, and recovery from, creasing. The recovery from deformation is, of course, the more important improvement. However, other properties should not be overlooked. For example, laundry shrinkage is decreased; the fastness of certain dyes is improved; and the strength of rayons is increased.

With all these improvements there inevitably are some undesirable effects. Urea-formaldehyde and melamine-formaldehyde are widely used as crease-resistant finishes. A serious drawback to the use of these materials is that they tend to weaken cotton fabrics, especially with regard to abrasion resistance and tear strength. Also, they retain chlorine, which is used in laundering, and the fabrics are thus quickly destroyed by the acids that are formed. In an effort to minimize the undesirable effects of aminoplast finishes, the possibility of modifying them with other materials, such as polymeric latices, was investigated. Polymeric latices were selected for this purpose because of the success experienced in the Southern Research Institute laboratory with acrylonitrile-butadiene latex as a permanent abrasion-resistant finish for cotton fabrics *(1)*.

* Presented by Edward Abrams on September 19, 1954 at Atlanta, Ga.

TABLE I

EFFECT OF CONCENTRATION OF U-F RESIN* ON WRINKLE RECOVERY OF COTTON CHAMBRAY

U-F Resin Concentration (%)*	*Pickup (%)*	*Wrinkle Recovery, Degrees*	
		Warp	*Filling*
10	4.3	126	113
20	8.2	136	138
30	10.9	142	141

* Rhonite R-1 used.

PROCEDURE

In the first phase of this investigation three different acrylonitrile-butadiene latices made by B F Goodrich Chemical Co (see Table II) were mixed in varying proportions with a urea-formaldehyde monomer (Rhonite R-1, manufactured by Rohm & Haas Company)[1].

For these experiments, cotton chambray fabric (without crease-resistant finish) was used. Samples approximately 16½" x 18" were cut from the bolt of chambray, and the warp ends and filling yarns were raveled approximately ⅝" from each edge. The treating mixtures were prepared to give a total of 20% solids concentration. In our selection of the concentration of urea-formaldehyde solids to use throughout these experiments, the recommendations of Rohm and Haas Co were followed to a certain extent. The brochure "The Rhonite Resins" *(2)* contains a recommendation that about a 10% solution of Rhonite R-1 be used for adequate crease resistance. Our studies, however, have shown that the 10% mixture is "on the borderline" with regard to wrinkle recovery (see Table I). The pickup of 4.3% from a 10% mixture indicates that

[1] Rhonite R-1 was selected as the representative of a class of modified U-F monomers.

TABLE II

IDENTIFICATION OF LATICES

Code	*Latex Type*	*Average Particle Size, Microns (6)*
L1 Hycar 1561	butadiene-acrylonitrile, high nitrile	0.06
L2 Hycar 1512	butadiene-acrylonitrile, medium nitrile, synthetic emulsifier	0.06
L3 Hycar 1571	butadiene-acrylonitrile, high nitrile, modified	0.12
L4 Hycar 1562	butadiene-acrylonitrile, medium nitrile	0.06
L5 Hycar 1551	butadiene-acrylonitrile, high nitrile	0.20
L6 Hycar 4501	polyacrylic ester	0.18
L7 Geon 552	polyvinyl chloride, rubber plasticized	0.18
L8 Geon 450 x 167	polyvinyl chloride, internally plasticized	0.18
L9 Geon 652	polyvinylidene chloride	0.17
L10 Geon 576	polyvinyl chloride, liquid plasticized	0.19
L11 Hycar 2507	butadiene-styrene, very high styrene	0.06
L12 Goodrite TS-40	ammonium polyacrylate	solution
L13 Goodrite K-708	sodium polyacrylate	solution
L14 Goodrite TS-20	polyacrylic acid	solution
L15 GRS 2000	butadiene-styrene, low styrene	0.12

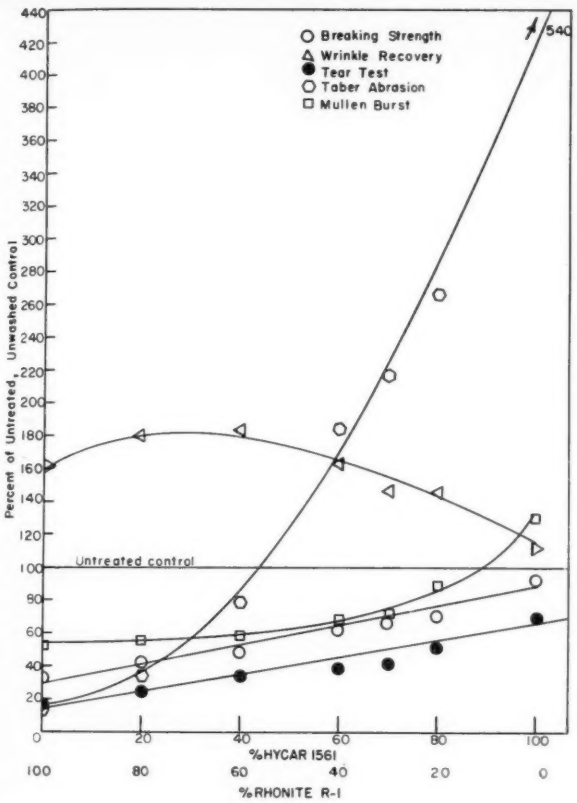

Figure 1
Effect of varying Hycar 1561:Rhonite R-1 on properties of treated chambray

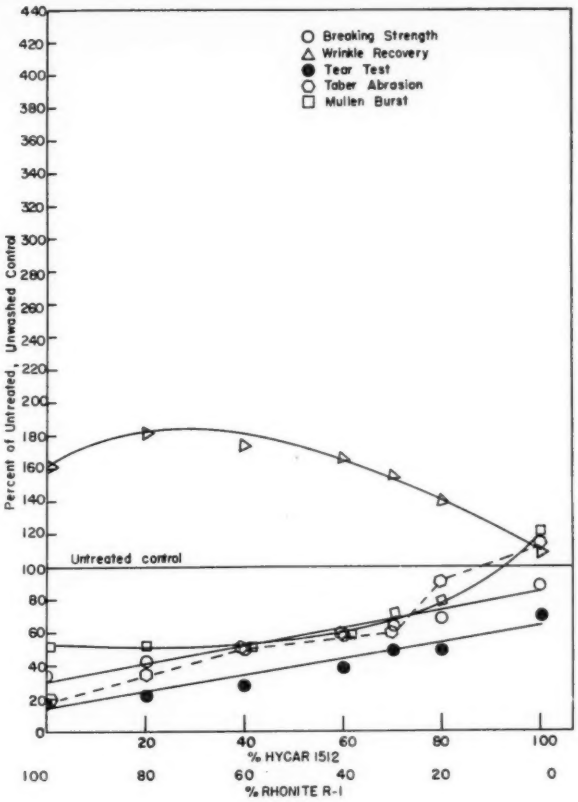

Figure 2
Effect of varying Hycar 1512:Rhonite R-1 on properties of treated chambray

our roll pressure may be too high to achieve a pickup which would give a higher angle of recovery. For this reason 20% was selected as the basic concentration for the various candidate mixtures. Table III lists the materials and proportions used in each mixture.

SINGLE-BATH TREATMENT——Samples of fabric were immersed separately in a single bath containing the various components, squeezed, folded in half, and then passed through a Butterworth padder twice at 30-lb roll pressure. The fabrics were dried immediately on tenter frames under minimum tension at 212°F ± 10°F for ten minutes. The samples were cured at 300°F ± 5°F for five minutes and neutralized immediately in a 0.1% soda ash solution. The temperature of the wash water was approximately 120°F. After being washed, the samples were rinsed thoroughly, squeezed, and ironed dry with an automatic household iron set to "cotton" heat. The samples were dried to constant weight at 220°F, and the pickup in percent was computed for each sample.

Table IV and Figures 1, 2, and 3 indicate that, when all properties are considered, the best ratio of latex:resin is in the vicinity of 70:30 on the dry basis. It can be seen in Figures 1 and 3 that the increase in concentration of L1 and L3 in the latex/resin mixture greatly increases the resistance of the fabric to abrasion as measured by the Taber Abraser. The tear strength and breaking strength are considerably improved when compared with the strengths of the resin-treated fabrics. This effect is in proportion to the added amount of latex in the formulation. However, the strength is still below that of the untreated fabric.

Kaswell *(3)* states that "There appears to be a general opinion that a crease-recovery angle of at least 125° is necessary in order for a fabric to exhibit acceptable performance." The fabrics treated with latex/resin in all proportions, with the exception of the 100% latex treatment, have a crease recovery angle greater than 125°. Moreover, in most cases the recovery angle is well above 125°.

Table IV indicates that, except for abrasion resistance, the results of all tests are essentially the same both before and after one washing.

In general the butadiene-acrylonitrile latices, when used with U-F resins, show a yellowing after the hypochlorite test *(4)*. The greater the butadiene-acryloni-

TABLE III

LATEX/U-F RESIN FORMULATIONS

(Water added to each mixture to make 500 ml)

Code[1]	*U-F Resin*[2] *(g)*	*Catalyst A (g)*	*Santomerse S*[3] *(ml)*	*Latex (g)*
L0	200	5	20	0
L1-20	160	4	20	51.5
L1-40	120	3	20	103
L1-60	80	2	20	154
L1-70	60	1.5	20	180
L1-80	40	1	20	206
L1-100	0	0	20	257
L2-20	160	4	20	50.3
L2-40	120	3	20	101
L2-60	80	2	20	151
L2-70	60	1.5	20	176
L2-80	40	1	20	202
L2-100	0	0	20	252
L3-20	160	4	20	50.9
L3-40	120	3	20	102
L3-60	80	2	20	153
L3-70	60	1.5	20	178
L3-80	40	1	20	203
L3-100	0	0	20	254

[1] See Table II; L0 = all Rhonite R-1.
[2] Rhonite R-1 — 50% active material.
[3] Santomerse S — 30% solids.

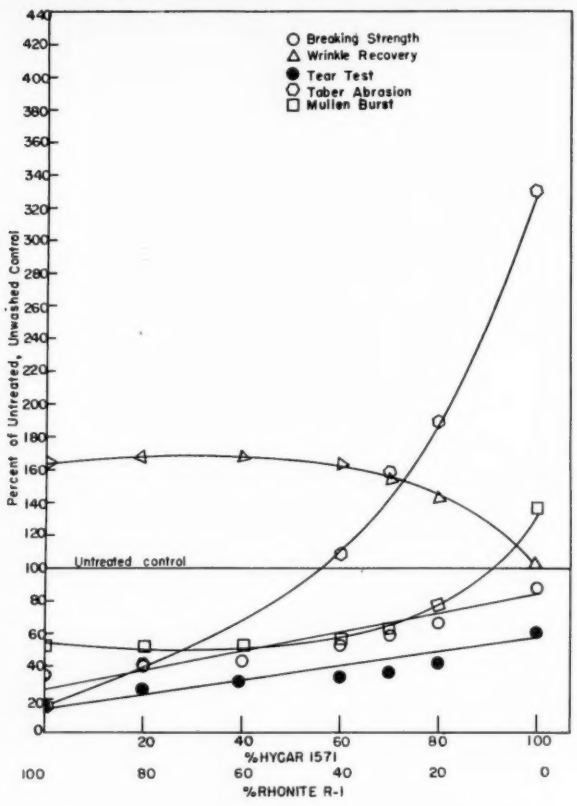

Figure 3
Effect of varying Hycar 1571:Rhonite R-1 on properties of treated chambray

TABLE V

LATEX (70%)/U-F RESIN* (30%) FORMULATIONS

Code[1]	U-F Resin* (g)	Catalyst A, (g)	Santomerse S, (ml)	Total Solids in Latex (%)	Latex (ml)
L1-70	60	1.5	20	38.9	180
L2-70	60	1.5	20	39.8	176
L3-70	60	1.5	20	39.3	178
L4-70	60	1.5	20	38.6	181
L5-70	60	1.5	20	50.8	137
L6-70	60	1.5	20	50.8	137
L7-70	60	1.5	20	49.4	142
L8-70	60	1.5	20	52.2	134
L9-70	60	1.5	20	50.6	138
L10-70	60	1.5	20	56.2	124
L11-70	60	1.5	20	40.5	173
L12-70	60	1.5	20	25.0	280
L13-70	60	1.5	20	25.0	280
L14-70	60	1.5	20	25.0	280
L15-70	60	1.5	20	40.0	175

* Rhonite R-1 used.
[1] See Table II.

trile latex content, the more pronounced the yellowing effect. However, these latices do show an improvement in bursting strength after the hypochlorite test. In Table IV it is seen that the all resin-treated fabric has a residual bursting strength of 54.2%, whereas L1-70 has a value of 72.1% and L2-70, a value of 73.8%. L3-70, on the other hand, shows little improvement over the all resin-treated fabric.

The results of the first phase of this investigation indicated that the best ratio to work with was latex (70%):resin (30%). It should be noted that throughout this work all latex/resin mixtures

TABLE IV

RESULTS OF TESTS ON UNFINISHED CHAMBRAY TREATED WITH LATEX/U-F RESIN* FORMULATIONS

Code[1]	Pickup (%)	Residual Breaking Strength (%)		Wrinkle Recovery[2] (degrees) Before Wash		After Wash		Residual Tear Strength[3] (%) Before Wash		After Wash		Shrinkage (%)		Residual Bursting Strength[4] (%)			Abrasion Cycles[5]	
		Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Before Wash	After Wash	After Chlorine Treated	Before Wash	After Wash
Untreated	—	100	100	82	97	84	95	100	100	84.0	85.2	—2.5	+1.9	100	118.0	116.1	239	252
L0	9.5	44.2	22.4	138	155	139	152	23.7	14.8	23.7	14.8	—0.5	0	52.5	62.4	54.2	43	51
L1-20	10.9	56.5	26.4	161	165	164	164	28.9	14.8	26.3	14.8	—0.3	—0.3	55.7	64.0	50.8	81	85
L1-40	11.5	61.4	33.3	168	164	166	160	42.1	22.2	36.8	18.5	0	—0.6	59.0	62.4	59.0	190	139
L1-60	12.9	78.8	40.6	143	151	163	145	47.4	29.6	42.0	25.9	—0.3	0	65.6	69.0	62.4	441	261
L1-70	12.4	82.5	45.6	139	126	141	136	50.0	33.3	47.4	29.6	—0.1	—0.5	72.1	73.8	72.1	518	295
L1-80	11.3	86.5	50.5	136	125	140	130	58.0	40.8	50.0	37.0	—0.3	—0.3	88.5	80.4	72.1	591	430
L1-100	11.2	108.2	73.1	107	97	104	104	71.0	70.3	65.7	51.9	—0.7	—0.2	129.5	129.5	111.2	1293	449
L2-20	11.2	56.0	28.3	163	164	160	154	23.7	14.8	31.6	14.8	—0.7	—0.5	52.5	55.7	57.5	83	83
L2-40	11.4	63.4	36.3	159	155	159	151	34.2	18.5	34.2	18.5	0	—0.1	50.8	57.4	50.8	123	98
L2-60	11.1	70.4	42.7	153	145	151	149	44.7	29.6	42.4	29.6	—0.1	+0.2	59.0	62.4	60.6	142	170
L2-70	10.9	79.0	44.9	148	134	151	136	55.3	37.0	50.0	29.6	—0.4	—0.1	72.1	67.2	73.8	143	174
L2-80	10.8	84.5	50.7	133	121	131	131	55.3	40.8	55.3	44.4	0	—0.4	78.6	80.4	78.6	220	199
L2-100	11.5	100.8	74.0	103	92	105	85	68.5	74.0	73.7	66.6	—0.5	+0.3	121.1	123.0	96.6	272	317
L3-20	10.4	50.4	25.2	156	149	152	157	34.2	18.5	26.3	11.1	0	0	52.5	54.2	47.5	100	84
L3-40	11.7	56.6	25.8	161	143	163	159	36.6	18.5	34.2	18.5	—0.3	+0.2	52.5	55.7	57.3	161	159
L3-60	11.6	66.5	35.6	144	153	150	153	39.4	22.2	36.8	22.2	0	—0.3	55.7	57.4	54.1	258	289
L3-70	11.9	72.5	40.5	144	135	149	142	42.1	25.9	47.4	29.6	—0.1	+0.2	64.0	64.0	57.3	382	354
L3-80	11.9	79.5	49.5	132	126	138	148	50.0	33.3	47.4	33.3	—0.2	+0.2	75.5	72.1	62.4	453	469
L3-100	11.6	98.5	76.6	90	93	102	98	65.7	55.5	60.5	51.8	—0.7	—0.7	136.0	121.1	118.0	792	788

* Rhonite R-1 used.
[1] See Table II.
[2] Monsanto wrinkle-recovery test.
[3] Elmendorf tear test.
[4] Mullen burst test.
[5] Taber Abraser with CS-10 Calibrase wheels.

TABLE VI

RESULTS OF TESTS ON UNFINISHED CHAMBRAY TREATED WITH LATEX (70%)/U-F RESIN* (30%) FORMULATIONS

Code[1]	Pickup (%)	Residual Breaking Strength (%)		Wrinkle Recovery[2] (degrees)				Residual Tear Strength[3] (%)				Shrinkage (%)		Residual Bursting Strength[4] (%)			Abrasion Cycles[5]	
				Before Wash		After Wash		Before Wash		After Wash								
		Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	Before Wash	After Wash	Chlorine Treated	Before Wash	After Wash
Untreated	—	100	100	82	97	84	95	100	100	84.2	85.2	—2.5	+1.9	100	118.0	116.4	239	252
L0	12.0	43.1	33.9	145	151	138	144	27.6	16.7	27.6	12.5	0	+0.2	56.4	60.0	56.4	45	39
L1-70	12.4	82.5	45.7	139	126	141	136	50.0	33.3	47.4	29.6	—0.1	—0.5	72.1	73.8	72.1	518	295
L2-70	10.9	79.0	44.9	148	134	151	136	55.3	37.0	50.0	29.6	—0.4	—0.1	72.1	67.2	73.8	143	174
L3-70	11.9	72.5	40.5	144	135	149	142	42.1	25.9	47.4	29.6	—0.1	+0.2	63.9	63.9	57.4	382	354
L4-70	13.2	72.0	43.8	154	154	149	149	52.6	29.6	42.1	25.9	0	+0.1	72.1	70.5	68.9	347	340
L5-70	11.9	72.0	42.6	147	145	144	148	47.4	33.3	44.7	29.6	0	+0.1	72.1	68.9	65.6	241	342
L6-70	12.8	67.2	33.8	148	128	144	137	42.1	22.2	42.1	25.9	0	+0.3	60.7	67.2	63.9	184	211
L7-70	11.6	72.0	69.0	134	131	141	137	41.4	33.3	41.4	33.3	—0.1	—0.1	70.9	67.3	69.1	490	348
L8-70	13.7	57.3	60.8	124	132	132	130	37.9	33.3	38.0	33.3	0	0	65.5	67.3	60.0	289	274
L9-70	12.8	67.9	66.7	113	116	131	132	31.0	29.2	31.0	25.0	+0.4	+0.3	65.5	61.8	58.2	236	207
L10-70	11.8	73.2	73.7	111	125	126	125	41.4	33.3	44.8	37.5	—0.1	0	69.1	70.9	74.5	279	244
L11-70	12.9	72.4	67.8	108	108	99	102	31.0	29.2	37.9	33.3	+0.4	+0.3	72.7	69.1	63.6	224	234
L12-70	4.7	76.8	79.6	108	99	97	104	62.1	58.3	58.6	54.2	—0.2	+0.5	83.6	80.0	67.3	280	273
L13-70	1.2	83.7	87.9	83	91	75	80	69.0	62.5	65.5	66.7	—0.3	—0.2	109.1	136.4	105.5	237	287
L14-70	6.9	36.6	42.5	104	104	107	100	34.5	25.0	34.5	29.2	—	—	63.6	61.8	58.2	155	132
L15-70	13.0	89.4	85.0	93	92	93	93	27.6	25.0	34.5	29.2	+0.3	+0.2	78.2	80.0	74.5	659	381

* Rhonite R-1 used.
[1] See Table II.
[2] Monsanto wrinkle-recovery test.
[3] Elmendorf tear test.
[4] Mullen burst test.
[5] Taber Abraser with CS-10 Calibrase Wheels.

were on the dry weight basis. In our attempt to find a latex/resin treatment that might minimize chlorine retention in the treated fabric, several different latices, composed of butadiene-acrylonitrile, butadiene-styrene, polyacrylates, and polyvinyl chloride, were used in the latex (70%):resin (30%) formulation. The materials are listed in Table V.

Table VI indicates that the modification of the U-F resin formulation with latices L1 through L6, in the ratio of latex (70%):resin (30%), generally results in a highly crease-resistant fabric. The tearing-, breaking-, and bursting-strength qualities of the fabrics so treated show a marked improvement over those in the all-resin-treated fabrics. However, they

TABLE VII

RESULTS OF TESTS ON UNFINISHED CHAMBRAY TREATED WITH LATEX/RESIN* FORMULATIONS IN TWO STAGES

Code[1]	Treatment	Pickup (%)	Wrinkle Recovery[3] (degrees)		Accelerotor Weight Loss[4] (%)	Residual Breaking Strength (%)		Residual Tear Strength[5] (%)		Residual Bursting Strength[6] (%)
			Warp	Filling		Warp	Filling	Warp	Filling	
Untreated		—	69	80	1.0	100	100	100	100	100
Resin (100%)	20% solids in bath	12.0	145	151	26.2	43.1	34.0	27.6	16.7	56.4
Resin (100%)	6% solids in bath	3.7	126	137	7.3	58.5	54.0	55.2	54.2	71.0
L1 (100%)	14% solids in bath	7.6	80	80	0.9	—	—	—	—	—
L1 (70%)/Resin (30%)	20% solids in bath	12.2	138	131	3.4	70.5	78.8	51.7	33.4	74.5
Resin (6% solids) + L1 (14% solids)[2]	fabric treated with 6% Rhonite R-1, cured, then treated with 14% L1	14.0	136	133	5.6	—	—	—	—	—
L1 (14% solids) + Resin (6% solids)[2]	fabric treated with 14% L1, dried, then treated with 6% Rhonite R-1, and cured	11.0	137	138	5.3	—	—	—	—	—
L6 (100%)	14% solids in bath	7.4	101	73	0.9	—	—	—	—	—
L6 (70%)/Resin (30%)	20% solids in bath	12.0	144	145	5.3	71.0	60.5	51.7	45.8	87
Resin (6% solids) + L6 (14% solids)[2]	fabric treated with 6% Rhonite R-1, cured, then treated with 14% L6	11.9	137	136	5.0	—	—	—	—	—
L6 (14% solids) + resin (6% solids)[2]	fabric treated with 14% L6, dried, then treated with 6% Rhonite R-1 and cured.	10.5	146	137	7.2	—	—	—	—	—

* Rhonite R-1 used.
[1] See Table II.
[2] Treatment made in two steps.
[3] Monsanto wrinkle-recovery test.
[4] Abraded for 4 minutes at 1500 rpm in AATCC Accelerotor.
[5] Elmendorf tear test.
[6] Mullen burst test.

are not as good as those in the untreated fabric. The L1-70-treated fabrics have very good resistance to creasing as well as good strength and excellent resistance to abrasion, but there is considerable yellowing after these fabrics are subjected to the hypochlorite test. In the case of L6-70, the abrasion resistance and strength is only slightly lower than for L1-70, but there is no yellowing after the hypochlorite test. In addition, the L6-70-treated fabrics have excellent wrinkle recovery, which is equal to or better than that of the L1-70-treated fabrics.

Fabrics treated with formulations L7-70 through L15-70 have comparably high strengths, but the crease resistance is generally poor, and in most cases the fabrics have a harsh hand. Thus it can be concluded that formulation L6-70 offers the most practical solution to the problems that beset the users of urea-formaldehyde crease-resistant finishes.

TWO-STEP TREATMENT —— A further study was made using latices L1 and L6, together with U-F resin, to ascertain the effect of a two-step treatment. A 6% bath of resin (the 30% resin in Tables III, IV and VI) and 14% baths of both L1 and L7 (the 70% L1 and L6 in Tables III, IV, and VI) were prepared. Chambray fabrics were treated with the 6% resin size baths, dried, cured and neutralized in the manner described previously. Some of these fabrics were treated with a 14% solution of L1 and some with 14% solution of L6. The operations were then reversed on another set of fabrics. The results are given in Table VII. Results of an additional test are also listed in this table.

During the second stage of our investigations we acquired an AATCC Accelerotor. Our results with this machine were so uniform that we abandoned the Taber Abraser and made all subsequent abrasion resistance tests with the Accelerotor. The method of testing is described in the Appendix.

In Table VII it can be seen that, when the latex and U-F resin are padded in separate operations, the crease recovery angle is approximately the same as for the one-bath treatment, previously described. Furthermore, it seems to make little difference, as far as crease recovery and abrasion resistance of chambray is concerned, whether the latex is padded first or the resin is padded first. It should be noted that, when the resin solids content in the all-resin treatment is reduced from 20% to 6%, the wrinkle recovery remains within acceptable limits, and although the Accelerotor weight loss is improved, it is higher than latex/resin-treated fabrics. Also, it should not be overlooked that the hand of the 6%-resin-treated fabrics is quite soft as compared to that of fabric treated with the 20% concentration of resin or with the latex/resin formulation, which is also a 20% total solids mixture. Furthermore, it can be seen that the breaking strength of the 6%-resin-treated fabric is higher than that of the fabric treated with the 20% concentration, but is lower than those of the L1-70 and the L6-70 formulations. Thus it cannot be said that the improvement in fabric properties, due to the use of latex/resin formulations, is brought about chiefly by the reduction in concentration of the urea-formaldehyde. The latex plays a definite part in the improvement in abrasion resistance, breaking strength, bursting strength, and hand.

SUMMARY

It appears that the two best treatments are the L1-70 and L6-70 formulations. Although the strength and abrasion resistance of L6-70-treated fabrics are not quite as high as in the case of L1-70-treated fabrics, the yellowing due to chlorine retention is not a problem in the L6-70-treated fabric; for this reason it may be the more desirable treatment.

ACKNOWLEDGMENTS

The assistance of H Paul Whitten and Jeanette Esslinger in the accumulation of data and in the preparation of this paper is gratefully acknowledged by the authors.

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APPENDIX

Shrinkage Test

Two 16½" x 18" samples, treated with each formulation, were washed in the Launder-Ometer using a modified ASTM No. 3 wash test. Before washing, a 10-in square was basted on one of the samples from each treatment. The dimensions of the square were determined after ironing.

Hypochlorite Treatment (4)

A sodium hypochlorite solution containing 0.37% available chlorine was prepared by adding 75 grams of Clorox to 1000 ml of distilled water. Three fabric samples (each approximately 8½" x 17") were placed in 700 ml of the solution. The fabrics were: latex/resin-treated, all Rhonite R-1-treated, and an untreated control. The temperature was raised to 140°F, and the solution was stirred for 10 minutes. The fabrics were then removed from the solution and were immersed in 500 ml of distilled water for 30 seconds during which time they were stirred vigorously. At the end of the 30 seconds, the samples were removed, squeezed, and immersed again for 30 seconds in another 500 ml portion of distilled water. This process was repeated until the fabrics had been washed in five separate portions of distilled water. The fabrics were ironed with an automatic household iron at 275°F to 280°F (iron set to "rayon" heat) for a period of 80 seconds in each area of a sample. The iron was placed on a section of the fabric for 10 seconds, then it was removed for 10 seconds, placed back for 10 seconds, etc, until the iron had been in contact with the same section for a total of 80 seconds. After conditioning at 70°F and 65% rh, the three samples from each test were finally tested on the Mullen burst tester.

Breaking Strength Test

ASTM grab method, using a Model J-2 Scott tester.

Wrinkle Recovery Test

The Monsanto wrinkle-recovery meter *(5)* was used.

Tear Test

The Elmendorf tear tester was used without the augmenting weight.

Bursting Test

The Mullen burst tester was used.

Abrasion Resistance

1) *Taber Abraser*—Abrasion resistance was tested on a Taber Abraser equipped with CS-10 calibrase wheels. No auxiliary weights were used.

2) *AATCC Accelerotor*—Two samples, 5½" x 5½", were cut from each treated fabric. The edges were raveled approximately ⅜" from each edge and were cemented with Ubabond, a rubber-base bonding material, to prevent raveling. The samples were dried to constant weight at 220°F. The fine abrasive liner No. 250, and the 4½" straight propeller were used. All samples were abraded at 1500 rpm for 4 minutes. A watt-meter in the circuit indicated that the power consumed was essentially the same for all samples. After abrasion, the samples were again dried at 220°F and the final weight was obtained. The percent weight loss due to abrasion was then calculated.

1954 Annual Convention——

THE INFLUENCE OF TEMPERATURE ON VAT-DYE APPLICATION*

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This paper reviews the progress made in the commercial application of laboratory-gained knowledge on the effects of temperature on vat-dye application. A broad outline of process development is given, together with comments on the advantages and limitations of applying the sodium salts of vat-dye leuco compounds to cellulose at temperatures of 70-270°F. Some collected data on diffusion and vatting rates are quoted, and the effects of heat on vat-dye dispersions and the high-temperature soaping of vat dyeings are described.

INTRODUCTION

IT has long been known that an increase in dyebath temperature is generally synonymous with an increase in the rate of diffusion of direct and vat dyes into fibers. It is also a well-established fact that an increase in application temperature brings about a decrease in the amount of dye absorbed by the fiber at equilibrium. Today, both dyers and printers of vat dyes are taking advantage of these facts by making use of abnormally high temperatures of application, and it is considered useful to outline and discuss the development, advantages and limitations of such processes. This paper will be confined to the application of vat dyes to cellulosic fibers.

HISTORICAL

In the early years of this century, when the growth of the vat-dye range was making rapid progress, it was found possible to classify these dyes into three broad dyeing groups according to their behavior in relatively long liquors. The dyeing groups IN, IW and IK are still well known and have stood the test of time in the majority of dyeing processes, and all newly introduced products are still classified accordingly.

By empirical means, the old indigo dyer learned that by raising the temperature of the vat the affinity of leuco indigo for the cotton fiber fell off very rapidly. He could improve penetration by this means, but he could not get the desired value until he brought the vat to room temperature again. Indigo has a small dye molecule and exceedingly low affinity for cellulose, even under the best of conditions. As the vat-dye molecules began to increase in complexity with the introduction of new dyes of improved shades and fastness properties, it was found necessary to search for means of minimizing their affinities for cellulose, and the dyeing world is still pursuing a constant quest for techniques and agents which will minimize strike, improve penetration and produce level goods.

Of the countless vat-dyeing assistants available at the moment, ranging from complex man-made products to naturally occurring substances, most of them will go only a part of the way towards the production of completely level dyeings from awkward dyes, difficult combinations of dyes, dense fabrics, dense yarns and textiles containing inherent imperfections. Probably the most valuable line of attack to date has been by way of temperature regulation. It is true this has been supplemented by technological progress in the field of improved dyes, improved dyeing assistants and improved dyeing machinery, but it is felt that regulation of the thermal condition of a dyebath represents perhaps the most important single factor.

Up to about the year 1930 it was considered sacrilege to apply vat dyes above about 140°F. Today they are being applied at temperatures in the region of 260°F. This calls for special conditions and special equipment, which was not available until very recent years.

In 1939, Boulton and Morton *(1)* published measurements on the relative rates of diffusion of reduced vat dyes in viscose film. They showed, for example, that over the temperature range 113 to 194°F there was a 2-fold to 15-fold increase in diffusion rate for "weak-alkali" vat dyes and a 5-fold to 20-fold increase in rate for "strong-alkali" vat dyes. Several examples from Boulton & Morton's epic work are quoted in Table I.

The figures quoted in Table I bear a very close relationship to a classification of the Caledon dyes on cotton made on the basis of a white-skein leveling technique in which temperatures of 68, 122 and 176°F were used during leveling periods of 40 minutes. Migration was assessed by use of the 1-5 grey scale recommended by the Vat Dyes Committee of the Society of Dyers & Colourists *(2)*; see Table II. A grading of 5 indicates that equal depth was obtained between the original dyed skein and the white skein.

Another important factor concerning the influence of temperature on vat dyes has recently been uncovered by Marshall

TABLE I

INFLUENCE OF TEMPERATURE ON DIFFUSION

(Boulton & Morton, *1*)

	Relative Rate of Diffusion in Viscose Film (μ^2 per min)		
	113°F	*140°F*	*194°F*
Caledon Gold Orange G (CI 1096)	56	140	430
Indanthren Brill Orange RK (Pr 116)	81	180	—
Indanthren Brown BR (Pr 118)	8	—	15
Caledon Green RC	5	26	90
Alizanthrene Navy Blue R (CI 1100)	11	59	170
Indanthren Khaki 2G (Pr 122)	—	1	1

* Presented in the Atlanta Biltmore Hotel in Atlanta on Thursday, Sept 16, 1954, before the Symposium on Dyeing Textiles with K S Campbell presiding. Ms recd by Editor of Proceedings on Aug 11 and by the Am Dyestuff Reptr on Sept 27.

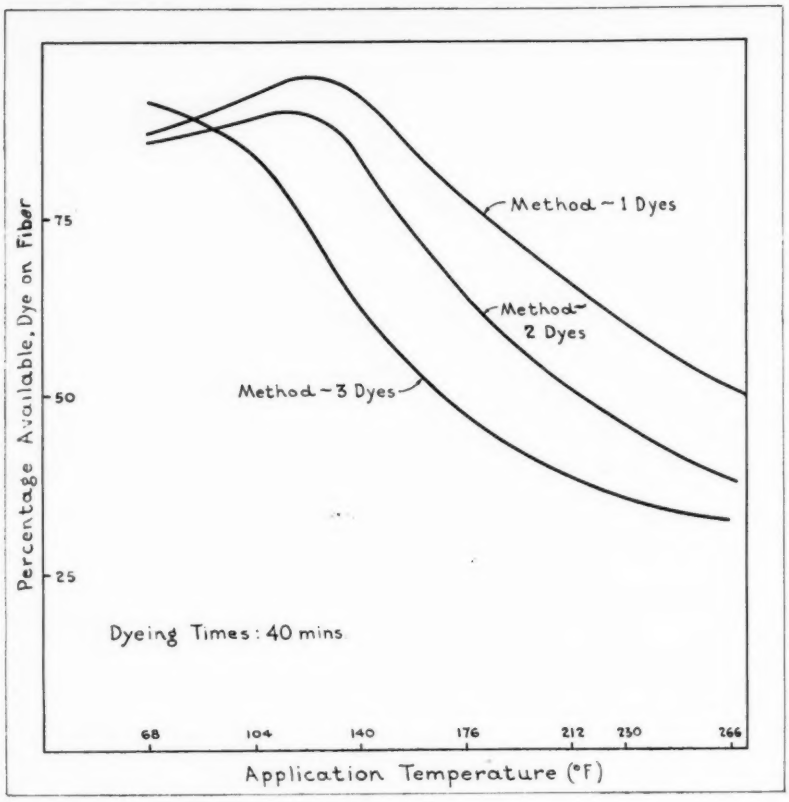


Figure 1

and Peters *(3)*, who have shown that increases in temperature make a profound increase in the rate of reduction of vat dyes (see Table III).

Marshall *(4)* has also made the statement that the rate of reduction of vat dyes around 212°F is of the order of 30 to 60 times greater than that at room temperatures. These factors are in complete accord with the experience of the users of the Standfast molten-metal machine and pad-steam ranges and also with what the screen and roller printers are finding in the flash-age process of vat-dye fixation.

Turning now to the practical advantages which can be taken of this knowledge, it must be noted that for a long time dyers have made what use they could of gradual-temperature-rise processes for the production of level goods. Furthermore, it was found a long time ago that liberties could be taken with a high proportion of the available dyes in the direction of abnormal temperature elevation during dyeing. Thus it became common practice for skein dyers of mercerized yarns to raise the final temperature of their dyebaths to 175-190°F in order to improve penetration. This type of procedure is limited, however, by the instability of many reduced vat dyes to overreduction and other well-known forms of chemical modification which are known to take place. The addition to the dyebath of various dye-damage inhibitors in the shape of sodium nitrite, hydroxylamine salts, dextrines and maltose has extended the range of dyes applicable at high temperatures. These products, however, seldom give complete protection of the leuco dye under all conditions of high-temperature dyeing, and it is still essential to choose dyes that remain sufficiently stable for relatively long periods under the thermal conditions employed. In the more modern processes of continuous dyeing and indeed printing there is a marked trend towards the use of shorter and yet shorter dyeing processes, and this presents the opportunity of preserving the reduced vat dyes in a stable form, since it is a fact that decomposition is partially controlled by the time factor.

Unlike pigment dispersions of vat dyes, the sodium leuco compounds of dyes that are not chemically modified under high-temperature reduction conditions appear to give improved solutions when the temperature is elevated. Although there is no experimental evidence to show that leuco dyes become nearer to a molecular state of dispersion under these conditions, this view must be considered since indirect evidence appears to lend support to the view. This recalls the work of Goodall *(5)* in his development of a process for dyeing wool with acid dyes. This process consisted of entering the wool directly into the boiling dyebath. Goodall showed that the colloidally dispersed dyes like Polar Yellow R at high temperatures gave solutions which closely approached those from molecularly dispersed dyes like Acid Orange GG. On the other hand, Fowler, Michie and Vickerstaff *(6)*, in their study of vat-dye isotherms, postulated that the four leuco vat dyes studied, viz Caledon Yellow 3G (CI 1132), Caledon Red 5G (CI 1131), Caledon Gold Orange G (CI 1096) and Caledon Yellow GN (CI 1118) were not appreciably aggregated in solution at 105°F, even in the high electrolyte concentration normally present in a dyebath. Valko, however, has recorded *(7)* aggregation numbers for leuco vat dyes in solution as high as 3.8 at 77°F. The literature shows a paucity of detail on this subject, and for the time being it is necessary for the technologist to take note of empirical results.

RECENT WORK

RELATION OF STRIKE TO TEMPERATURE ——— In work recently carried out it has been found that the unlevel-dyeing anthraquinonoid vat dyes, which normally give a high strike on cellulosic fiber at 140°F, will give very much less strike at 260°F and at the same time will give a very much lower tinctorial yield in a practical dyeing period, eg, up to 90 minutes. Similarly, it has been shown that even the cold-dyeing vat gives lower dyebath exhaustion at 260°F than they do at their normal application temperature of 70-80°F when applied for times up to 90 minutes. If the affinity of

TABLE II

MIGRATION OF VAT DYES ON COTTON

(SDC White-Skein Technique, *2*)

	68°F	*122°F*	*176°F*
Caledon Gold Orange G (CI 1096)	1	3	5
Caledon Brill Orange 6R (Pr 116)	3	5	5
Caledon Dark Brown 3R (Pr 118)	1	3	4-5
Caledon Green RC	1	1-2	3-4
Alizanthrene Navy Blue R (CI 1100)	1	2-3	4
Caledon Khaki 2G (Pr 122)	1	1	1

vat dyes for cellulose can be lowered in this way it provides a valuable tool, aiding the production of better-penetrated yarns and superior penetration of yarn packages. Providing that the full tinctorial value can be obtained from the quantity of dye present in the dyebath, then such a process of dyeing could have commercial possibilities. By a reversal of most dyeing procedures, ie, by using a cooling-bath process, for example, commencing dyeing at 260°F and cooling down the bath under controlled conditions, it becomes possible to feed the rest of the dye onto the yarn, providing the temperature is depressed to that which normally gives rapid exhaustion and maximum tinctorial yield.

The curves shown in Fig 1 illustrate the principles of this process. The type of data required to produce these curves was obtained by carrying out a number of separate 40-minute dyeings at increasing temperatures, eg, from 70 to 260°F and estimating the amount of dye present in extract liquors taken from the dyed cotton samples. It will be seen from these curves that in all cases (whether Method-1, Method-2 or Method-3 dyes) a very low exhaustion of the dyebath is obtained at the high temperatures. About 50%, or more, of the total available dye still remains in the dyebath at 260°F, and it was found by experiment that the quantity of dye absorbed did not increase when the dyeing time was prolonged to a period of 80 minutes.

PACKAGE DYEING AT HIGH TEMPERATURE———By commencing a package dyeing at 260°F and holding it at this temperature for a sufficiently long period (eg, 5-15 mins) to obtain complete penetration of the package with the small amount of dye which can be absorbed and then very gradually reducing the temperature to say 120-140°F, it is possible to obtain perfectly penetrated packages and also to obtain full tinctorial yield. The course of such a dyeing is represented graphically in Fig 2. It has also been demonstrated in the laboratory that a vat-dyed package and an undyed package can be placed together in a blank vat and subjected to the conditions shown in Fig 2 to yield two perfectly level and equally dyed packages at the end of the process.

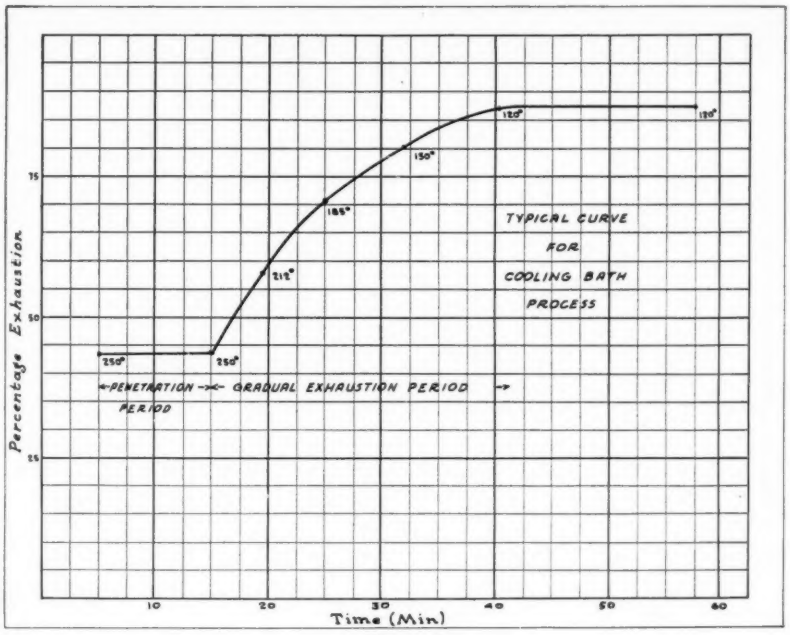


Figure 2

A cooling-bath process of this kind, which requires starting at 240-260°F, demands dyes of very good leuco stability, and it must be admitted that the range of suitable dyes currently available is limited. At the moment we know of little more than twenty dyes that are sufficiently stable for this process. Examples of stable dyes are: Ahcovat Flavone GC (Pr 9), Ahcovat Golden Yellow GK (Pr 291), Ahcovat Violet XBN (*CI* 1163), Ahcovat Dark Blue BO (*CI* 1099), Ahcovat Jade Green (*CI* 1101), Ahcovat Olive Green BL (Pr 293), Ahcovat Direct Black AC and Ahcovat Black BN (*CI* 1102). Successful dyeings of tightly wound, tightly twisted mercerized packages have been made under bulk conditions during the last few months. The special high-temperature machines now available from all the principal machine makers must, of course, be used. It is hoped that new dyes of satisfactory stability in reduced form will be developed to make this process of vat dyeing more widely adopted.

Butterworth *(8)* has shown that this type of vat dyeing can have an appreciable effect on the tenacity of viscose rayon but points out that very satisfactory pigmentations of viscose-rayon cakes, have been made in relatively short times by using high temperatures (250°F); this can then be followed by a lower reduction temperature to preserve the normal tenacity of the yarn. In such cases of high temperatures pigmentation — unnecessary for the more robust cotton fiber which can generally be leuco dyed — it is advisable to avoid the use of polyethanoxy dispersers and anionic wetting agents based on sulfated fatty acids as pigmentation aids. Such products are known to cause rapid aggregation of pigment particles at temperatures greater than the atmospheric boil. There is always a tendency for insoluble pigment particles to aggregate as the temperature of a dispersion is elevated, but ranges of vat dyes carefully prepared for prepigmentation techniques, eg, FD Caledon Powders Fine, are satisfactory for this process.

HIGH-TEMPERATURE SOAPING ———The fact that pigment dispersions tend to aggregate at high temperatures is doubtless connected with the observation that vat dyeings soaped at 250°F rapidly develop their true shade. Vat dyeings made from the indanthrone blues on cotton, eg, Caledon Blue XRN (CI 1106), Caledon Blue GCP (CI 1112) and Caledon Blue XRC (CI 1113) exhibit excellent shade characteristics (superior redness and brightness), which is accompanied by an appreciably greater resistance to

(Continued on page P796)

TABLE III
TIMES OF HALF REDUCTION OF VAT DYES
(Marshall & Peters, *3*)

	104°F seconds	*140°F seconds*	*Increase in Rate of Reduction due to 36°F Temperature*
Caledon Gold Orange G Paste Fine (CI 1096)	36	15	2.4
Caledon Navy Blue 2RS Paste Fine	31	8	3.9
Caledon Jade Green XNS Paste Fine (CI 1101)	50	13	4.1
Caledon Pink RL 200 Paste Fine	181	59	3.1

Hudson-Mohawk Section——

FLAMMABILITY AND THE LAW*

HERMAN E HAGER

General Dyestuff Company

The first and still presently active chairman of the AATCC Committee on the Flammability of Clothing Textiles gives a history of flammability testing in the United States and of the need for it that arose because of the many deaths resulting from burning clothing in the 1940's. He then brings us up to date with respect to methods, equipment, and state and Federal legislation on the subject.

IT will be ten years this next February that the National Retail Drygoods Ass'n asked the AATCC to study fabric flammability and that Prof Olney requested me to form a committee and to find, if possible, a method that would differentiate between safe and dangerous clothing textiles. I appointed members from different technical backgrounds — the textile industry, fiber producers, testing laboratories, retailers — and we went to work first to study the subject. All fabrics except fiberglass burn, but with considerable difference. Wool and silk burn slowly; acetate, nylon, and the new synthetics fuse, rayons and cottons burn freely but also with differences in rate. Tightly woven fabrics of close construction and well-twisted yarns usually make up into perfectly safe garments, but open constructions, like organdies, sheers, nets or fabrics with a pile or napped and brushed surface, are quite apt to be highly flammable.

There had not been too many cases of accidents up to the early forties, but after the war they were on the increase and reached a quite-alarming peak in 1945. The subject of flammability was brought sharply and tragically into focus in May of 1945 with a series of accidents resulting from the now infamous cowboy suit when ten small boys who played around a fire in Washington were either burned to death or severely maimed through the rapid burning of these garments. Many lawsuits resulted from these deaths and injuries, and, when last checked in late 1948, well over $2,000,000 in suits were pending, which were brought against all sections of industry: the retailer, cutter, fabrics manufacturer, fiber producer, and even the movie star who had sponsored the cowboy suits.

Our Research Committee, which had been ardently at work for four months, at that time received additional impetus through these accidents. After a total of 18 months and a lot of conscientious labor we were able to set up a method and to develop an instrument, which were accepted by AATCC and were then promulgated by the Dept of Commerce as a proposed Comm Standard. It was disseminated to the industry for approval in November, 1946, but was turned down by the cotton group with the objection that the method was not accurate enough and not sufficiently tried out. Consequently, our Committee was asked to continue work on the subject. We enlarged the membership by taking in several additional technologists, three of them from the field of cotton textiles. We also obtained a $5,000 grant from the industry and obtained the exclusive services of an AATCC research associate in Lowell, who worked under the direction of our Committee for three years on the subject and who did a splendid job. The outcome was a somewhat improved machine and a modified method.

In the meantime legislation began to be introduced at the national and state levels. California was the first state to introduce and pass a law on flammable fabrics in January 1945 — a month before the inception of our Committee and one of the reasons for its creation. This law in all probability resulted from the indignation of a legislator's wife whose daughter had purchased a chenille dressing gown of flammable nature. The law banned from California "all textiles more flammable than cotton in its natural state." Of course, comparing the flammability of textiles with that of cotton in its natural state was too vague and uncertain to make such a law enforceable, but nevertheless it hit the textile trade in New York like a bombshell. It was through the efforts of our Committee member, Fred Bonnet of the American Viscose Company, who flew to Sacramento, that some order was brought into the chaotic condition of such legislation. In June, 1945, Gov Warren signed a bill that provided for the testing of the flammability of fabrics and garments of either cotton or synthetic fibers by the State Fire Marshal. The Marshal worked very closely with our Committee and later adopted our method and machine for his tests. Although the law as passed was not limited in scope to wearing apparel, fortunately when the Fire Marshal, as empowered by legislation and after various sessions with California interested parties and with three of our Committee members in Los Angeles, issued rules and regulations that applied only to wearing apparel. If this had not been the case, there would have been thousands of fabrics and articles affected by this law which had been used for years without ever causing trouble.

Two bills were introduced in Congress in Washington: one by Representative Johnson of California and one by Canfield of New Jersey. These bills were quite similar but took into consideration an unnecessarily large number of fabrics. Both of these bills used a test developed by the National Bureau of Standards to determine whether or not a fabric would be considered flammable. This was a horizontal test, and in later study did not prove to be so reliable as that developed by our AATCC Committee. Neither of these bills was considered sound, so the National Retail Dry Good Association drafted a third bill, restricted to wearing apparel, relying on the proposed Commercial Standard for a test method. This bill was introduced in the House by Representative Arnold of Missouri and in the Senate by Senator Capehart of Indiana.

Hearings on all three of these bills were held by the House Interstate and Foreign Commerce Committee, at which several of our AATCC Committee members testified; there were no Senate hearings. There was a great deal of argument at the House hearings concerning test methods and whether or not a method was available that was sufficiently accurate to serve the purpose.

In the meantime the Comm Standard had not been approved by Industry, and a Standing Committee including all interested parties was set up for the proposed Comm Std. This Standing Committee later appointed a Technical Comm to study and revise the proposed Comm Standard.

The three bills mentioned before did

* Presented before the Hudson-Mohawk Section at Jack's Restaurant in Albany, N Y, on Friday evening, Sept 24, 1954. The ms was recd by the Editor of Proceedings on Sept 21 and by the Am Dyestuff Reptr on Sept 27.

not pass but did serve the purpose of calling to the attention of industry the seriousness of the problem. Even though the Comm Standard was not approved, a large number of manufacturers bought our AATCC tester and began to control their production. There was also a lot of publicity on the subject in the daily press and in magazines with many articles originating from our Committee members. The upshot of all this was a most salutary education of the public and a steady drop of accidents from highly flammable fabrics. Our Committee maintained a statistical survey of incidents involving flammable textiles and the NRDGA subscribed to a newspaper clipping service of accidents. Whereas the number of these was appalling in 1945 and was still very large in '46, accidents became fewer and fewer and finally petered out in 1947-48, and the clipping service was then discontinued as unnecessary.

The whole flammability question was becoming dormant until suddenly, around Christmas, 1951, we were faced with a flood of the so-called torch sweaters. Although no one was killed wearing them, there were a great number of accidents, since the sweaters burned so rapidly that they certainly were a terrible hazard. Incidentally, none of these sweaters were sold in stores; they were passed on to the consumer entirely by peddlers. The whole operation, in fact, was very "phony". The several fly-by-night irresponsible manufacturers tried to imply that the sweaters were camel hair when they were actually made of heavily brushed rayon.

The advent of the torch sweaters revived interest almost overnight in the question of flammable fabrics. We had in rapid succession a whole series of proposed state laws from New York, Massachusetts, Michigan, and several other states. Most of these laws, however, were not passed at that time.

So, it became very apparent that, unless we obtained national legislation, we would be faced with a series of state laws, all of which would be different, with different test methods and different requirements. The textile industry would soon find itself in a drastic condition trying to meet these requirements in different states.

Therefore, a law somewhat modified from the one first introduced in 1945 was again introduced in Congress, and in 1952 that law was passed by the Senate but failed in the House by one vote. At that time we did not yet have an approved Commercial Standard. However, the modified version was being circulated and was finally accepted as CS 191-53 in January 1953. The law, further modified, was again proposed in June of that year, was passed by both the House and Senate, and was signed by President Eisenhower on June 30th, one of the provisions being that the law would become effective one year later. This means that Public Law #88, known as the Flammable Fabrics Act, has been in force since this past June 30th. It sets the following standard of flammability:

"Any fabric or article of wearing apparel shall be deemed so highly flammable within the meaning of this Act as to be dangerous when worn by individuals if such fabric or any uncovered or exposed part of such article of wearing apparel exhibits rapid and intense burning when tested under the conditions and in the manner prescribed in Commercial Standard promulgated by the Secretary of Commerce effective January 30th, 1953, and identified as 'Flammability of Clothing Textiles, Comm Std 191-53.'

If at any time the Secretary of Commerce finds that the Commercial Standard is inadequate for the protection of the public interest, he shall submit to the Congress a report setting forth his findings together with such proposals for legislation as he deems appropriate."

The law further charges the Federal Trade Commission with its administration and enforcement. The law also establishes a method whereby a guarantee may be executed to the effect that reasonable and representative tests show that the fabric covered by the guarantee is not so highly flammable as to be dangerous when worn by individuals.

The fabrics that are banned are those that fall in Class III of the Commercial Standard and of our AATCC standard described as fabrics showing rapid and intense burning. Textiles free from nap, pile, tufting, flocking, or other types of raised fiber surface in their original state and/or after being dry-cleaned and washed as provided in Commercial Standard shall be classified as Class III, rapid and intense burning, when the time of flame spread is less than four seconds. Napped-pile, tufted, flocked or other textiles having raised fiber surfaces in their original state and/or after being drycleaned and washed as provided in Commercial Standard shall be classified as Class III, rapid and intense burning, when the time of flame spread is less than four seconds and when the intensity of the flame is such as to ignite or fuse the base fabric.

You will note that the intensity of the flame is considered in the case of raised-surface-fiber fabrics. Of the three characteristics of fabric flammability, the ease of ignition and the rate of burning can be established with fair accuracy on our tester, but the intensity of the flame, which is an important and fickle factor in raised-fiber fabrics, is left to the visual observation of the experimenter. The real danger of such fabrics results from a rapidly spreading flame, which often has sufficient intensity to cause the fabric to ignite over a wide area. It has so far not been possible to measure this intensity, and our Committee has been attempting for several months to accomplish this — a problem which offers considerable difficulties, but which we hope, for the sake of a more accurate evaluation of these raised-fiber fabrics, to establish in due time.

Last April 29th (two months before enforcement of the law) Senator Purtell of Connecticut, under pressure from certain industries, introduced in the Senate his Amendment S-3379, "Exemption from Flammable Fabrics Act of Fabrics and Wearing Apparel Not Highly Flammable", which proposed withdrawal of silk scarfs and also a change of conditions under which the present tests are conducted from bone dry to 65% RH. Although our Committee had some data on the subject, which moved us originally to set up the bone-dry requirements, this Purtell Amendment forced us into an immediate thorough investigation of the problem. We conducted a series of comparative tests in five laboratories with ten fabrics, one portion of each in dry condition and another conditioned four hours at 65% RH. The results showed that the flat fabrics — three organdies and a rayon sheer — had an average increase of 25% in burning time when tested at 65% RH against bone-dry. With the other raised-fiber fabrics, that increase was considerably higher. The exposure to 65% RH raises the moisture content of these to a level where many of them do not ignite any more in one second. This amendment might have been welcomed by certain industries, but it would have emasculated the standard and might well have invited trouble. It was not passed by the House, but on September 2nd President Eisenhower signed an amendment according to which the burning time of flat fabrics was lowered from four to three and a half seconds, or a mere 12½%, and that slight concession, which is a help particularly to manufacturers of organdies and sheers, is now incorporated in the law. But all tests must continue to be carried out in dry condition, which is a characteristic of our AATCC standard.

In conclusion I want to emphasize a few points. The Flammable Fabrics Act, I believe, will not exercise a hardship on industry; it affects probably not more than 1½-2% of clothing textiles, and only this small portion will have to be tested. It will surely eliminate from the market all the really dangerous garments. We will just not have torch sweaters, cowboy suits, and the like any more. In that respect the Act will be a needed protection to the public, but we must not lose sight of the fact that practically everything we wear will burn and that there will always be cases of clothing catching fire from carelessness under conditions where injury might result.

Philadelphia Section——

SPUN-DYED VISCOSE*

L L WALMSLEY

American Viscose Corp, Marcus Hook, Pa

Spun-dyed viscose rayon textile, in which water-insoluble, fast-to-light pigments are added to the viscose (cellulose xanthate solution) before it is spun into rayon, has the following advantages over rayon that is dyed after spinning: closer matches from lot to lot, better penetration, better levelness, and better light- and wet-fastness properties. These advantages will lead to the production of a spun-dyed rayon in America as it has in England and on the Continent, especially of staple fabrics, which generally need to be faster to washing than filament fabrics. The author discusses how certain economic and practical considerations, however, will operate to bring a balance between spin dyeing and piece dyeing in the rayon industry in spite of the better quality of spin dyeing.

INTRODUCTION

SPUN-DYED viscose rayon implies the addition of pigment or coloring matter at the manufacturing source prior to the spinning operation. The problems of research are numerous, including many that are familiar to the dyer, such as careful selection of pigments to ensure satisfactory color fastness, the compatibility of the pigment with the spinning solution, the problems of matching shades, and the ability to reproduce the same shade repeatedly. For the evaluation of the fastness properties of spun-dyed viscose and their relationship to current fabrics and trade requirements the manufacturer has leaned heavily upon the test methods outlined in the AATCC TECHNICAL MANUAL & YEARBOOK and is deeply appreciative of the great amount of work and study which resulted in the various test procedures. The fact that they are accepted as standard practice is of incalculable value in measuring specifications for spun-dyed viscose. The mechanical problems of producing spun-dyed yarns are many and varied and are not all solved at this point, this being particularly true of filament. For example, it is not possible to guarantee that there will be no variation in depth of color as spinning proceeds. There may not be any, but the conditions under which an exactly colored viscose must be spun are not all known, and it is to be expected that, as in anything else, improved techniques will come as a result of greater experience.

GENERAL DISCUSSION

SPIN DYEING——The method of producing spun-dyed viscose may be described briefly as follows: A batch of viscose-rayon spinning liquid is first prepared with a high-pigment content. Subsequently, it is injected into the main stream of unpigmented rayon spinning liquid to give the desired degree of coloration before being pumped to the spinnerets. Thus it is easily possible to by-pass the color line to produce undyed viscose, and, moreover, the color can be changed without too much difficulty. It will be realized that the foregoing is quite general and that each manufacturing plant will have its own methods and processes.

COST OF SPUN-DYED RAYON——The cost of spun-dyed viscose is not yet fully determined; however, it will bear a relationship to the cost of the required pigments and to added manufacturing costs, and the cost of each color will therefore be individual. Current charges are approximately 35 cents per lb above those for natural filament yarn, whereas for spun they will vary between 5 to 24 cents above those for natural staple with the bulk being about 12 to 15 cents. For obvious reasons it can be assumed that prices of domestic spun-dyed viscose will be close to those of foreign origin. The relatively higher cost of filament over staple yarn reflects the higher cost of filament yarn in general and the greater difficulties involved in producing filament yarns over spun yarns. The fastness properties of spun-dyed viscose are in most cases superior to those of naphthol- or vat-dyed yarns, and in all cases superior to those of yarns dyed with simple directs, developed directs or sulfur colors. By fastness, of course, is meant fastness to the usual tests for dyed materials, and these tests include those for fastness to light, washing, perspiration, crocking, cross dyeing and kier boiling.

SPIN DYEING VS DYEING——The production and use of spun-dyed rayon has a very recent history in the United States and has only come into prominence in Europe in the past four or five years, although the process was known twenty years ago. It may be of interest to discuss briefly the pros and cons of spun-dyed compared with dyed yarn and fabric. Spun-dyed filament possesses an obvious advantage over spun-dyed staple in that it is normally used as purchased, and the contamination encountered in spinning spun-dyed staple in the mill as well as other problems is not a factor in filament yarns. Comparing spun-dyed filament yarns with undyed filament yarns as previously mentioned, we find that the cost may be approximately 35 cents above greige costs, whereas dyeing costs are 20 to 30 cents for direct colors or 40 to 80 cents for vat colors per pound depending on the shade. The particular advantages in spun-dye viscose are fastness properties, lack of knots and greige-yarn quality, as well as very close matches from lot to lot. What the customer loses is, first, individual selection of color, which may be important, and, second, the necessity for greater color inventory. However, academically the advantages are all on the side of spun-dye and, for those who are able to take advantage of it, the resultant fabric will be much superior both from the point of view of fabric quality and colorfastness. It is not to be expected that, in all cases or even in the majority of cases, there will be an immediate switch to spun-dye, for the individuality of dyed yarns may be much more important than improved colorfastness. In a great many fabrics the fastness of direct colors is quite satisfactory and there is no demand for improved fastness qualities. There is a strong possibility that with spun-dyed filament yarns new uses will be found for viscose, such as auto seat covers, which have already proved successful.

SPUN-DYED FILAMENT RAYON——It is a fairly safe prediction that, as spun-dyed filament viscose gets into greater production in the United States, the filament-yarn-dyeing industry will be affected, but, where filament is used in the woven state, eg, linings, taffetas, satins, crepes, ribbons and piece-dyed braids, this is not likely to be true because, in the first instance, the fastness requirements are

* Presented at the Penn-Sherwood Hotel in Philadelphia on Friday, Sept 24, 1954.

quite moderate and for the most part are quite satisfactory, and nothing would be gained by adding spun-dyed fastness. Secondly, the cost of finishing these fabrics is quite low, and the added cost of spun-dyed viscose over greige yarn would be much greater than the finishing charges. Of course, the material would require finishing whether it was spun-dyed or in the greige, so that there would be a finishing charge. The finishing prices are so highly competitive that the cost of finishing whether or not it includes dyeing would be very little different as they are mainly light shades dyed with direct colors. Probably the greatest deterrent to the general use of spun-dyed yarns in what are normally piece-dyed filament fabrics is the inventory problem, the extra cost of warping each individual color, extra cost of manufacturing up to finishing. It should be borne in mind that this field is highly specialized and the costs are extremely closely calculated. The market will not pay for added qualities which are not completely justifiable. However, it should also be kept in mind that, if public fancy dictated the use of spun-dye because of advertising or as a result of "glamorizing" spun-dye, the foregoing thoughts could change rapidly. Basing calculations on hard factual thinking and considering the market on its past history as well as on current experience, we are of the opinion that spun-dyed rayon will not greatly affect the dyeing industry for filament-piece goods; and any gain will be in newer fabrics where fastness is of prime consideration.

SPUN-DYED STAPLE VISCOSE——— Turning from filament to staple rayon we have an anomalous situation: it is axiomatic that it is economically advantageous in this country to dye and finish a textile in that state of manufacture that is as near as practically feasible to the market state of the textile. It is for this reason that the great bulk of spun fabrics are piece-dyed. The extra cost of spinning colored fiber, which can run 30-50% above undyed yarn, and the extra cost of warping and weaving, as well as the loss in value of colored waste, are all saved by piece dyeing. In addition, the selection of colors can be decided upon as the market dictates, and the manufacturer does not have the responsibility for colors that are subject to change without notice.

BRITISH EXPERIENCE

In Britain, which has had the bulk of the experience and on whose background we must draw for evaluation, it is in the staple field that spun-dye viscose has made its greatest progress in spite of the above deterrents. Courtaulds, for example, according to their statement released to the press, sold 25,000,000 pounds of spun-dyed staple last year, and 25% of all production will be spun-dyed this year. This will mean approximately 50,000,000 pounds. The reasons for this might bear examination so that we can be guided in our efforts to determine whether the sudden growth of spun-dye in Britain might be followed by a similar experience here:

1) There is much more stock dyeing and top dyeing in Britain than here, and it is a natural step from stock-dye to spun-dyed staple either in staple or top. In fact, it would be economically unsound to refuse to accept spun-dye at 8 cents extra when it costs 12 to 15 cents to stock-dye.

2) The capacity of the average dyehouse in Britain as on the continent is quite small compared with that in the United States, and, in addition, the size of the average lot to be dyed is much smaller than in this country. This and other factors make their dyeing charges higher than ours, and, by comparison, makes spun-dye relatively more attractive there than here.

3) Their trade is more accustomed to the soft woolen-type garment, which calls for blends and styles that require stock dye; and stock dyeing lends itself again to spin dyeing. Because of their demand for custom cloths, all of their lots are very small and require more varied effects, which can be only obtained by stock dyeing; and the purchase of spun-dyed staple at a comparatively low price becomes very appealing.

4) The piece-dyeing trade in Britain, at least for rayons, has been practically all carried out with direct dyes. The introduction of the much faster spun-dyed staple at very little extra cost has been a welcome advantage for the consumer and has been a selling point to the converter.

If the above reasons have permitted spun-dyed viscose staple to attain some success in Britain, what has been their final experience with this fabric, and why is it increasing in volume? The following advantages are attributed to spun-dyed viscose fabrics over piece-dyed fabrics:

1) *Much better color fastness* — This was an advantage where colorfastness had not been satisfactory, especially when the results from different dyers were so various.

2) *Closer matches* — It is possible to match much closer from lot to lot of spun-dyed staple. This, as is well known, is particularly important where a large number of pieces are cut at one time.

3) *Solidity of appearance* — The color in spin dyeing is much more solid in appearance than in the corresponding piece dyeing because of the fact that the spun-dyed fiber is penetrated more uniformly than the piece-dyed fiber, in which the dye normally penetrates only the outer ring of the fiber.

4) *Improved quality* — The quality of spun-dyed fabrics from the point of view of unevenness due to filling bands or warp streaks is much superior and, of course, there cannot be streaks as a result of dyeing or end-to-end and side-to-center shading, which are normal hazards of piece-dyeing operations. These then are the four major advantages of spin-dyeing viscose staple found in British experience.

CONSIDERATION OF AMERICAN MARKET

The effect on the American market at the moment is not impressionable; however, the advantages are there and they are being carefully evaluated.

It is certain that the reasons given above are not all those that have given impetus to spun-dyed fabrics in Britain, and, basically, it can be seen that the reasons given above would not apply in an exactly analogous manner in the United States. There are some however, which would also be effective here, especially if aided by advertising. The American market is very susceptible to advertising, and American merchants can create and have created demands for fabrics that had no previous history. More important, the market will not buy materials that are not advertised. As this is well known, it is to be expected that spun-dyed rayons will be given full attention in the advertising field. This then could affect the thinking on piece-dyed fabrics, doubly so if it were found by the consumer that the qualities claimed were substantiated, such as superior fastness properties.

Much more than the British or Continental, the American public has been sold on permanency in fabrics relative to color fastness and shrinkage. That this is no doubt due to the fact that any one fabric manufactured must meet all climatic conditions. Manufacturers cannot produce two lines of the same fabric, one suited to the hot climate of Florida and one for the cold climate of Maine. An interesting example is one which has been argued at great length, and that is rayon and rayon-blend summer suitings. Is it necessary that they should be fast to washing? Dry cleaning should be sufficient except in the deep South, where washing is necessary to eliminate perspiration problems. Washing implies both nonshrinkage characteristics and colorfastness, and some of the success of rayon suitings is due to the advertised washability. But are they washable, and if they are not, will that not eventually cause an unfavorable reaction? In the rayon-shirting field the dyeing

industry by and large has been very weak in regard to washability and its implications. That this has been so has been both understandable and excusable in the past. However, today in increasing measure what has been good enough in the past is not sufficient today. It is asked, for instance, why should a cotton shirt or dress material be expectedly vat dyed, whereas, a similar rayon fabric be dyed with direct colors.

CONCLUSION

As previously mentioned, piece dyeing is traditionally and for reasons of economy the accepted method of producing colored fabrics. It can remain so and no doubt will remain so for a considerable time. It can remain so if the converters and dyers will process their fabrics in such a manner that the required end use of the material is satisfied. In the filament field, by and large, direct dyes are suitable for most purposes excepting draperies and curtain fabrics. In the spun-rayon field almost all fabrics should be vat- or naphthol-dyed whether dark or light shades, and, where necessary should be completely washable under any conditions. If these specifications are not met, then the spun-rayon dyeing industry by their own inadequacy will promote the acceptance of spun-dyed rayon by the American public.

Membership Applications

November 5, 1954

SENIOR

Dominic H Aldi—Dyer, Scientific Dyers Ltd, Lodi, N J. Sponsors: H F Clapham, T J Roos.

Edward F Armatys—Chief chemist, Rarolite Chemical Co, Raritan, N J. Sponsors: H B Goldstein, E T McIlwain.

William Beck—Chemist-Colorist, Dyestuff Dept, American Cyanamid Co, Boston, Mass. Sponsors: C. Mackenzie, J H Grady.

Henry A Birdsall—Member of technical staff, Bell Telephone Labs, Inc, Murray Hill, N J. Sponsors: N A Johnson, C A Whitehead.

Thomas J Bivens—Section head, Burlington Mills Corp, Greensboro, N C. Sponsors: J G Stass, F K Burr.

Albert A Bouchard—Asst dyer & overseer, Hathaway Mfg Co, New Bedford, Mass. Sponsors: P W Cook, T N Madden.

Roy S Cooke—Asst foreman, Muscogee Mfg Co, Columbus, Ga. Sponsors: W A Holton, J M Buckner.

Edward Coss—Dyer, Dutchess Underwear Corp, Old Forge, Pa. Sponsors: T H Hart, T R Scanlan, Jr.

Robert A Dardenness—Director, Cia Peruana Francolor S A, Lima, Peru.

Ramon B Diaz—Group leader, chemist, Colgate-Palmolive Co, Jersey City, N J. Sponsors: K H Barnard, J A Woodhead.

Otto P Durheimer—Textile chemist & colorist, Sandoz Chemical Works, Inc, New York, N Y. Sponsor: C W Saalfrank.

Bruno J Falanga—Assistant chemist, research, American Woolen Company, Inc, Lawrence, Mass. Sponsors: A Morrison, H D Grimes.

Anthony Garcia—Tech sales repr, Ansbacher-Siegle Corp, Staten Island, N Y. Sponsors: R C Riglian, H H Bander.

Alphonse W Gaucher—Dyer, Greenville Finishing Co, Greenville, R I. Sponsors: G T Roberts, A R Sims.

Phyllis E Grant—Asst prof of clothing & textiles, Oregon State College, Corvallis, Ore. Sponsors: F E Petzel, E E Stout.

Bernard Isenogle — Dyehouse foreman, Aurora Bleachery, Inc, Aurora, Ill. Sponsors: F H Gurry, A T Oleson.

Homer R Ketchie—Salesman, Diamond Alkali Co, Charlotte, N C. Sponsors: F K Burr, F W Sturtevant.

George V Kubu—Lab tech sales, Nova Chemical Corp, New York, N Y. Sponsors: R H Funke, C A Funke.

Francis J Ladr — Wool dyeing-foreman, American Thread Co, Willimantic, Conn. Sponsors: P G Morin, W H Turner.

James B Mumma—Tech repr, Carbide & Carbon Chemicals, Co, Boston, Mass. Sponsors: J H McCormick, J W Walter.

Bailli Nilssen—Research director, Norwegian Textile Research Inst, Bergen, Norway. Sponsors: S Rotevatn, L R Buseth.

Philip H Orser—Supt of dyeing, Mass Mohair Plush Co, Lowell, Mass. Sponsors: J H Collins, D F Callahan.

Wladyslaw Potempski — Textile chemist-technologist, Barlow & Jones Ltd, Bolton, Lancashire, England.

Carmen C Rendino — Textile engineer, Consolidated Textiles Inc, Taunton, Mass. Sponsors: C Newland, P J Collins.

Joseph J Romano — Head dyer, Holly-Knit Inc, Fin Plant, Mount Holly, N C. Sponsors: J S Rogers, D B Norton.

Victor Schutz—Supt of dyeing, Phoenix Hosiery Co, Milwaukee, Wis. Sponsors: F E Schroeder, P D'Amour.

Paul T Sessions, Jr—Sales, Linde Air Products Co, Div Union Carbide & Carbon Corp, Birmingham, Ala. Sponsors: D G Carmichael, V G Paul.

Louis J Taylor — Chief chemist, Jersey State Chemical Co, Haledon, N J. Sponsors: R A Corio, C E Hutz.

James E Thornton—Asst to tech dir, Bibb Mfg Co, Research Dept, Macon, Ga. Sponsors: W F Kennady, R E Sheehan.

James O Whitaker—Textile chemist & colorist, Sandoz Chem Works, Inc, New York, N Y. Sponsor: C W Saalfrank.

Norbert Weinberg—Textile chemist, Buffalo Electro-Chemical Co, Buffalo, N Y. Sponsors: B K Easton, H O Kauffman.

W B Welch—Overseer-dyer of knitted yarns, American Thread Co, Willimantic, Conn. Sponsors: P S Morin, W H Turner.

JUNIOR

Thomas J Dicus—Textile chemist, Morgan Dyeing & Bleaching Co, Rochelle, Ill. Sponsors: A A Gorski, J L McGowan.

Robert F Hoban—Asst head of Paper Dept, Sandoz Chem Works, Inc, New York, N Y. Sponsors: C W Saalfrank, G J Greendonner.

Edward Victor—Lab tech, A D Juilliard & Co, Inc, New York Mills, N Y. Sponsors: M L Davis, A W Thomas.

ASSOCIATE

Eugene Blum — President, Transocean Commerce Inc, New York, N Y.

Edwin Conried—Merchandise mgr, Indian Mills, Inc, New York, N Y.

Maurice Deby—Manager, Cepea S A, Brussels, Belgium.

Sam Eisner—Foreman, Ideal Pleating Co, New York, N Y.

Arthur J Raynor, Jr—Sales repr, Becco Sales Corp, Buffalo, N Y.

STUDENT

John A Cardonna—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Arthur H Cole—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Harvey Feitlowitz — Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Herbert E Gochman—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Ruth S Hager—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Edward J Hogan — Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Jerry M Joseph—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Nykola Kostko—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Kenneth A Kovaly—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Charles B Littlefield—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Raymond C Miller—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Marie C Novak—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Leon D Palewsky—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

George E Saigh—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Zenon L Salewycz—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

Stephen C Tumminello—Fairleigh Dickinson College. Sponsor: H R Mauersberger.

ONE HUNDRED AND NINETY-THIRD COUNCIL MEETING

THE Council held its 193rd meeting at the Atlanta-Biltmore, Atlanta, Ga, on Wednesday morning, September 15, 1954. Present were President J Robert Bonnar, presiding; George L Baxter, Samuel L Hayes, Joseph H Jones and George O Linberg, *vice presidents;* Albert E Sampson, *treasurer;* Leonard S Little, *chairman of the Executive Committee on Research;* William D Appel, Henry F Herrmann, C Norris Rabold, Thomas R Smith and P J Wood, *past presidents;* Elmer E Fickett, John M Gould, Robert D Robinson and Sawyer F Sylvester representing Northern New England; Raymond W Jacoby and Thorwald Larson representing Rhode Island; Raymond J Carey representing Western New England; Matthew J Babey, Charles W Dorn, Herman E Hager, Weldon G Helmus, Patrick J Kennedy, and Paul J Luck representing New York; Albert E Herrmann, Jr representing Hudson-Mohawk; Carleton T Anderson, Edward C Diehl, Ange E Raimo, Ernest E Rettberg, Jr, Percival Theel and Frederick V Traut representing Philadelphia; Walter M Scott representing Washington; Harley Y Jennings, Raphael E Rupp, R Hobart Souther and Henry A Rutherford representing Piedmont; C Russell Gill representing Southeastern; Joseph D Mosheim representing South Central; Arthur T Brainerd, Samuel Klein and Elliott Morrill representing Mid-West; Kenneth H Barnard and Walter F Fancourt, III, of the Committee on Conventions; William A Holst, Jr of the Committee on Constitution and Bylaws; Glenn D Jackson, Jr of the Publicity Committee; Albert E Johnson of the Corporate Membership Committee; and Harold C Chapin, *secretary.*

On behalf of his Convention Committee, Russell Gill welcomed the Council to Atlanta.

There was a moment of silence in memory of the friendships and service to the Association of George H Schuler.

The Secretary's report of the 192nd Council meeting and financial statement of July 31st, and the audited Treasurer's report for the year ending July 31, 1954, were accepted. The budget for the current fiscal year was amended by addition of $11,000 for publishing a new edition of "Analytical Methods for a Textile Laboratory" and $50,000 toward publication of the *Colour Index.* The $600 already appropriated for color-transfer charts was increased to $650. Temporary investment of $50,000 in treasury bills and federal savings and loan associations, pending budget requirements, was approved. A loan to the Convention of 1955 of $3,000, including the $1,000 authorized in the Bylaws, was approved.

For the Executive Committee on Research, Mr Little reported on the International Standards Organization meetings of last June, at which six members of the Association were present. Our AATCC Wash Test #4 had been adopted without change. On shrinkage, satisfactory compromises had been reached. An ISO meeting would probably be held in connection with the Perkin Centennial Celebration in the week of September 10, 1956, in New York. A letter from George S Buck, Jr, regarding consumer standards, was referred to the ECR.

Mr Johnson outlined plans, which were approved, for doubling corporate membership and increasing annual income for research to $72,000. Inquiries as to possible new members had been mailed to the Council and others in the Association, and a study was being made of the amounts which might reasonably be expected from various corporate members in relation to their interests and volume of business.

Mr Barnard reported all exhibit space for the Atlanta Convention sold and paid for. Mr Fancourt discussed plans for the convention of 1955, September 22 to 25, in the Chalfonte-Haddon Hall, Atlantic City. Mr Jacoby announced that Walter M Scott would be chairman of the committee arranging the Association's technical program for the Perkin Centennial Celebration of 1956.

For the committee on *Colour Index* marketing, Mr Sampson showed samples of binding from the Society of Dyers and Colourists and from American sources. The Council favored the more substantial American bindings, even at higher cost, and restriction of gold lettering to edge of the cover. The secretary of the Association was asked to serve hereafter as secretary of this committee. It was requested that *Colour Index* proofs be corrected and returned as rapidly as possible to Mr Cady.

Mr Jackson reported for the Publicity Committee, acknowledging the help of Arthur R Thompson on the Atlanta Convention.

For the Publications Committee, Professor Theel announced completion of the *1954 Year Book.* In the revised list of colors in the 1955 volume, resin-bonded pigments would be listed in a section separate from the dyes, alphabetically according to trade names, and again according to principal pigment components. A special committee would be appointed to compile the list, in co-operation with manufacturers of resin-bonded pigments.

In accordance with recommendations of the Committee on Membership and Local Sections, presented by Mr Hayes, each of the following was elected to the class of membership indicated:

CORPORATE

The Dobeckman Co
Southern States Chemical Co
Good Housekeeping Institute

SENIOR

E J Baxter, C C Brauner, A R Buglione, B L Channer, V L Chase, J F Davis, R E DeLapp, C B de Maya, W P Dooley, M Engel, C E Fuller, J Greenblatt, J E Greer, G R Griffin, T L Hanley, W J Hart, S M Hull, Sr, R L Hunter, R R Kindron, J Knup, Jr, C N Kuzma, H L Lanier, Jr, C M Lindsay, Jr, A Masionis, J R Mauney, Jr, J Mazza, E K McMahon, R J Mentzer, G C Murphy, J J Pagani, W G Quick, R P Rhodes, J Sands, K Sawada, E Silvers, R F Stevens, C N Whitesides, R S Wilder, C E Whorley.

JUNIOR

C M Alberto, C B Anderson, E C Campbell, G S Dominguez, B E McCardle, A M Sironi, G Switlyk, A Van Der Woude.

ASSOCIATE

K Akaza, R Alaupovic, J L Cianciotto, C W Busch, Jr, C L Fulp, E D Grant, Jr, H F Krackenberger, B Livingstone, J A Masso, A A McIntyre, J E Navey, K Numajiro, D C Porter, J A Snyder, T H Wang.

TRANSFERRED FROM OTHER CLASSIFICATIONS TO SENIOR

E R Adams, J Balloch, Jr, B Blagman, B Blechman, R W Boyden, J H Campbell, A L Cate, J L Claiborne, J F Cobianchi, R J Coskren, S E Edwards, D H Fields, G H Fisk, W M Foley, R W Foltz, R F Goodwin, A N Green, D B Groves, M Haimchick, M C Harmon, E H Hartgrove, Jr, S Heisler, O E Herzog, S S L Ho, N M Hollis, W E Innone, J W Kirk, A G Kneeland, A W Knox, W E Kramer, J C Leininger, C A Lermond, T D MacLane, C Manevich, S J Martin, Jr, W B Mason, D M McAllister, E J McNamara, Jr, R H Meadows, J Moss, J F O'Donnell, J S Panto, G E Pederson, G S W Poon, J Price, Jr, S C Ruffenach, E E St Louis, Jr, C E Schmidt, G F Sirine, J K Skelly, E P Stoetzner, E C Thornton, H L Trexler, Jr, W Wald, Jr, H P Walker, Jr, W V Walukewicz, R E Weber, H Wechsler, V F Wilkerson, Jr, D W Young, Jr, H A Zockoll.

Respectfully submitted,
H C CHAPIN,
Secretary.

ACTIVITIES OF THE LOCAL SECTIONS

Philadelphia

A SYMPOSIUM on dyeing and finishing featuring nine technical papers attracted a turnout of over 200 on the morning of October 30th as the Philadelphia Section met at the Philadelphia Textile Institute for its second session of the season.

Under the chairmanship of Carleton T Anderson, the program called for concurrent symposia on knit goods, yarns and woven fabrics, with Francis Nevins, Ciba Company, Inc, Frederick V Traut, Globe Dye Works Co, and Arthur W Etchells, Hellwig Dyeing Corp, as respective group chairmen. Aiding Mr Anderson in the organization of the meeting were Wm Sollenberger, *vice chairman;* Percival Theel, *treasurer;* Ange Raimo, *registration;* Frank Nevins, *luncheon;* and Thomas R Scanlan Jr, *publicity.*

The program in detail:

GROUP I———Knit Goods

"Dyeing of Synthetic Tubular Knitted Fabrics"———R C Geering, Princeton Knitting Mills

"New Developments in Tricot Dyeing"———L L Walmsley, American Viscose Corp

"Sweater and Hosiery Dyeing"———Henry Kline, Keystone Dye Works

GROUP II———Yarns

"Package Dyeing"———Ernest Caswell, Ciba Co, Inc

"Stock Dyeing"———Jackson Bauer, Fred Whitaker Co

"Mechanics of Dyeing Packages—Skein and Stock"———A P March, Smith-Drum & Co

GROUP III———Woven Fabrics

"Dyeing of Acrilan and Blends Containing Acrilan"———Walter Hindle, Chemstrand Corp

"Mechanical Aspects of Dyeing and Finishing"———Harry Creegan, James Hunter Machine Co

"Chemical Finishing of Fabrics"———Raymond Drukker, American Cyanamid Co

Correction

We regret an error which appeared on page P715 of the October 25th issue. Under "Activities of the Local Sections" it was stated that Socrates Vaniotis, newly elected chairman of the Western New England Section, is with American Cyanamid Co. Mr Vaniotis is with National Aniline Div, Allied Chemical & Dye Corp.

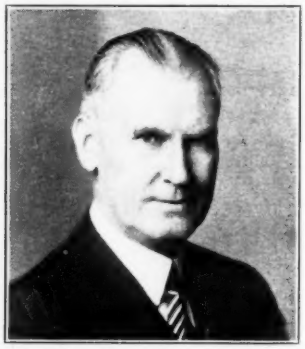
Annual Meeting—Piedmont Section

(See page P749 of previous issue for meeting summary)

OUTGOING OFFICERS OF THE PIEDMONT SECTION———Seated (l to r): Clarence Hooper, secretary; H J Jordan, Jr, vice chairman; Henry A Rutherford, chairman; C O Stevenson, treasurer (re-elected). Standing (l to r): Francis K Burr, sectional committeeman; Edward A Murray, chairman, sectional research committee (re-elected); Samuel L Hayes, national vice president (Southern Region); Dale W Kern, sectional committeeman; A R Thompson, custodian (re-elected); Warren E Rixon, sectional committeeman; Fred W Sturtevant, sectional committeeman; Harley Y Jennings, councilor (re-elected); R Hobart Souther, councilor.

NEW OFFICERS OF THE PIEDMONT SECTION———Seated (l to r); Warren E Rixon, secretary; Clarence Hooper, vice chairman; Herman J Jordan, Jr, chairman; Clement O Stevenson, treasurer. Standing (l to r): Henry A Rutherford, councilor; Neal A Truslow, sectional committeeman; Edward A Murray, chairman, sectional research committee; A R Thompson, custodian; L Earl Holt, sectional committeeman; Harley Y Jennings, councilor; George A Artope, sectional committeeman.

M M McCann (facing camera) presents past chairman's plaque to retiring chairman Henry A Rutherford.



Charles H Stone, in whose honor the Piedmont Section's "Charles H Stone Educational Fund" has been created.

Hudson-Mohawk

THE October 29th meeting of the Hudson-Mohawk Section, held at the Hotel Johnstown, Johnstown, N Y, featured a paper by F L Dennett, Dow Corning Corp, on the subject "Application of Silicones to Textiles." Mr Dennett supplemented his talk with illustrated slides and exhibits of various styles of fabric before and after treatment with silicone finishes.

Seventy-two members and guests, including George L Baxter, AATCC vice president (Central Atlantic Region), were in attendance.

Fairleigh Dickinson College

THE Fairleigh Dickinson College Student Chapter, comprising 28 members, held its first meeting of the new school year on October 26, in the Student Lounge. Featured speaker of the meeting was Joseph Zelek, vice president, Textile Colors Division, Interchemical Corp, who discussed informally "How to be a successful Textile Chemist." He concluded his remarks with an invitation to the group to visit the Division's plant in nearby Hawthorne, N J.

Business transacted at the meeting included the appointment of committees to arrange for area plant tours, to prepare a student contest paper, and to plan for future meeting programs. It was decided to hold meetings every second Tuesday of every month except December.

The following slate of officers was elected for the new year: *Chairman*———Michael Marriott; *Vice Chairman*———Vincent Bonavita; *Treasurer*———Martin Samwick; *Secretary*———Ruth Hager.

(See page P796 for photo of Fairleigh Dickinson Student Chapter)

REPORT OF THE NATIONAL CONVENTION COMMITTEE

CONVENTIONS have been an annual feature of AATCC since its founding in November, 1921, excepting the years during World War II when travel was restricted. Through a series of trials and errors, certain features which we now take for granted, were incorporated. The technical meetings have been the backbone of these conventions, and they remain the raison d'etre of our meetings. We have always had at least one annual banquet which gave our presidents a chance to report and advise us, and which offered a brief moment of glory to the hard-working general chairman of each convention and his assistants. Later, the Intersectional Contest, the Olney Medal Award, and the Alumni Luncheon became regular features. In addition to these "regular" features, the sponsoring section or regions have frequently introduced some distinctive novelties into the convention program, such as arrangements for attending the World's Fair in New York, the presentation of a musical program by the Boston Pops Orchestra at Boston, or most recently, the Tulane-Georgia Tech football game at Atlanta.

Arrangements for the earlier conventions called for them to be run and operated on a strictly local or sectional basis. Through the Council, a section would invite the Association to hold its next annual meeting in that locale. On the acceptance of the Association, all arrangements (including finances) were then handled directly by the sponsoring section. Naturally each section regarded this as a challenge, and the enthusiasm of the local committees was generated by a desire to put on the best possible meeting.

The birth of the National Convention Committee lay in the concept that some means should be found to take advantage of the experience and knowledge gained by the convention chairmen and their committees so that it could be passed on to future chairmen. This was accomplished by means of written reports from the chairmen of the various committees for each convention. The National Convention Committee incorporates them into a "Convention Bible," which is available to each new chairman. At the outset, the editing and circulation of these reports was a one-man job, which was purely advisory. However, past chairmen of conventions have been added gradually to the National Convention Committee so that new chairmen now have a body of experienced men with whom they can meet in formulating sound policies for future conventions.

In this connection, a questionnaire on convention "likes and dislikes" was mailed to every member of AATCC and a report on the results of this questionnaire was issued in the AMERICAN DYESTUFF REPORTER of January 8, 1951. The thoughts expressed by our members crystallized some of the thoughts already formulated by the Convention Committee into the following policies:

1) The location of the convention should rotate from year to year to give every member in the society a chance to attend at least one of these meetings in his own locale once in four or five years.

2) One formal banquet per convention is sufficient.

3) The general form or pattern of AATCC conventions as worked out over the years is acceptable to the majority of our members.

A matter on which there has been some disagreement in the past is the distribution of the surplus money taken in over actual convention expenses. AATCC has never had a convention that showed a loss, although sometimes the hosts in the South wound up exactly even. Usually there is a surplus and in the past this has led to the question as to whether this belonged to the local section or to the national body. Some local sections took it all, some kept none of it. Obviously a definite policy was needed so that officials of future conventions would know in advance what to expect and what was expected of them. Finally the Bylaws were amended (see Section 11, Article IV) so that a section sponsoring a convention is now entitled to the first $1000 taken in over expenses and 10% of anything above that.

The idea of holding exhibitions in conjunction with the annual conventions was introduced after World War II with the thought towards providing a central point for the display of dyestuffs, chemicals, fibers, testing equipment and textile machinery. The National Convention Committee thereupon set about to collect data on potential exhibitors and to determine their requirements while setting a policy as to who and what should be exhibited. When the exhibition became an established feature of the national conventions in 1949, the amount of money handled by the local treasurers rose from less than $10,000 to more than $30,000. This figure continues to rise. Recognizing that we are now engaged in business transactions of some magnitude, the Bylaws now provide for a national treasurer for conventions and the setting aside of proceeds from these conventions as a continuing fund. Recent conventions, therefore, have been run on a more business-like basis under a strict budget with carefully audited accounts by a bonded national treasurer.

The net result of all this has been the establishment of a pattern for AATCC conventions which seems to please the majority of those attending, and which reflects the aims and accomplishments of the society to the world at large.

KENNETH H BARNARD

Fairleigh Dickinson College Student Chapter—1954-55

Vat-Dye Application—

(Continued from page P787)

destructive oxidation by agents like sodium hypochlorite. This suggests that the submicroscopic micelles of the deposited pigment inside the fiber are in a higher state of compactness and hence more resistant to oxidative attack than when soaping is carried out at an atmospheric boil. If soaping treatments at 250°F are kept to a reasonable time, eg, 15-20 minutes, there is no visible increase in crocking, but if excessive times are used, it would be expected to increase such defects.

CONCLUSIONS

We have evidence, both practical and theoretical, that a fuller exploitation of the high-temperature application of vat dyes can greatly shorten dyeing times when cellulose-to-liquor ratios are very short, eg, in flash-age printing, which may yet be suitable for special types of over-all coloration at an even greater speed than possible by pad-steam dyeing. We have also evidence which suggests that a wider adoption of a cooling bath process—commencing at 240-260°F—can more rapidly lead to penetration on dense and difficult packages than conventional processes. The yarn-dyeing field is somewhat jeopardized by lack of a complete range of sufficiently stable dyes, but there is every hope that the continued demands for more dyes of a suitable character will spur our dye chemists to discover them.

REFERENCES

(1) Boulton and Morton, *J Soc Dyers Colourists* 55, 494 (1939).
(2) Report of the Committee on the Dyeing Properties of Vat Dyes, *ibid* 66, 505 (1950).
(3) Marshall and Peters, *ibid* 68, 289 (1952).
(4) Marshall, *ibid* 69, 686 (1953).
(5) Goodall, *ibid* 54, 45 (1938).
(6) Fowler, Michie and Vickerstaff, "The Affinity of Vat Dyestuffs for Cotton", *Tech Circ*, Imp Chem Inds Ltd.
(7) Valko, *J Am Chem Soc* 63, 1433 (1941).
(8) Butterworth, *J Soc Dyers Colourists* 69, 362 (1953).

QUESTIONS

Question: You have cautioned against the use of anion-active fatty alcohol sulfates in high-temperature vat dyeing. Do you recommend the use of any wetting agent in that method?

Answer: From all the experimental work we have done, I do not think that it is essential to use wetting agents for the prepigmentation of packages. Dyestuffs for prepigmentation techniques generally speaking contain dispersing agents, and these will keep the dyestuff in sufficiently fine form during the prepigmentation process for the high-temperature method, provided the goods have been reasonably well prepared. These dispersing agents, though various, as a general rule act well at high temperatures.

Question: Will the use of sodium formaldehydesulfoxylate increase the range of vat dyes applicable by high-temperature techniques, or is the addition of formaldehyde alone to a vat dyebath sufficient?

Answer: We have done a limited amount of work on the replacement or partial replacement of sulfoxylate in such processes. Our work is incomplete, but we have found, as did your South-Central Section in the Intersectional Contest last year, that sulfoxylate would go a long way in enabling us to dye very sensitive dyes like Vat Blue BCS, but we discarded the thing because we felt that the protection was not adequate. We have also found that sulfoxylate baths were much more sensitive to alkali concentration, and that it was necessary to adjust the sulfoxylate to each dye.

To quote a few examples, we found that Vat Red FBB was fairly rapidly destroyed with sulfoxylate, so that we could not find a right balance between caustic soda and sulfoxylate to give the correct shade. We have seen other dyes that were apparently protected to some extent by the use of sulfoxylate, and still others that were rapidly decomposed. We have therefore come to the conclusion that the use of hydrosulfite and alkali alone generally gave the best and simplest dyeing procedure. We have not made direct additions of formaldehyde to the vat in any of our work in this connection.

Question: You said you had no difficulty in getting penetration in the case of mercerized sewing threads. Did you find no limitations to that statement with respect to skeins of mercerized sewing thread?

Answer: I would not say that we might not ever have any difficulty, but we have satisfactorily handled packages of sewing threads, embroidery yarns, unmercerized yarns, and even linen yarns by the high-temperature method. In all cases we have obtained improved penetration over that obtained by conventional means. We do not claim, however, that the method is a panacea for all difficulties.

Viscose Coagulation in Relation to the Production of Crimped Rayon Filaments

B C M Dorset, *Textile Mfr* 80, 309-12, June, 1954.

In the spinning of viscose rayon the coagulation into individual filaments of the streams of viscose which issue at a high rate through the orifices of each spinneret into a bath containing sulfuric acid and sodium bisulfate, together with a small proportion of zinc sulfate, is generally regarded as being simple and straightforward, so that perfectly uniform solid filaments of regenerated cellulose are formed. Actually, according to the exact conditions of spinning and the composition of the coagulating bath the individual freshly-formed filaments may show marked differences.

When a stream of viscose leaves the spinneret orifice to move through the coagulation liquor, it is subject to continuously changing conditions. The liquor can only act on each viscose filament from the outside, so that, as coagulation proceeds and each filament acquires a skin of freshly regenerated cellulose, the penetration of the coagulant into the central core is modified. Thus, the nature of the regenerated viscose filament must change from outside to inside.

The interesting point is that this uneven coagulation of the filament can cause a pronounced crimp. Some of the research on this subject, conducted in USA and Japan, is described by the writer.

The Morehead-Sisson staining technique, using Victoria Blue B and Calcomine Brilliant Yellow, has proved very useful in distinguishing the skin of the filament from the core, the skin being dyed blue and the core yellow.

It is stated that about 33 percent of the present production of viscose rayon staple in Japan is made in a crimped state by the use of a modified coagulating bath with a lower concentration of acid and a high content of sodium sulfate, combined with stretching. Details of this process are given. Cross-sections of the crimped filaments show that the skin on one side is thicker than on the other.

The author also describes another method of producing crimp, in which two different types of viscose are fed to a composite spinning jet in such a way that there is no appreciable mixing of the viscoses. In the resulting filament one side will differ from the other. This is easily seen by coloring one of the viscoses.

Structurally uneven viscose filaments can also be produced by various mechanical variations in the spinning process (e g, by vibrating the spinning jet so as to disturb the viscose being extruded). —WHC

Textile Inter-Fiber Competition, 1952

Anon, *Textile Organon* 25, 113-24, Supplement, July, 1954.

This special Supplement presents the latest available data on 128 itemized end-uses of cotton, wool, hard and soft fibers, silk, linen, and the man-made fibers for the calendar year 1952. Corresponding totals by major end-use categories are also shown for 1937 and for 1949 through 1951.

The outstanding feature of the data continues to be the penetration by the man-made fibers of all divisions of the textile industry. It will be observed that the man-made fibers represented 23 percent of the total end-use consumption in 1952 compared with 7 percent in 1937.

Over the 16-year span, it will be further noted that consumption of the man-made fibers increased by 1,128,000,000 pounds, or 331 percent, while the corresponding increase for all other fibers was 545,000,000 pounds, or 10 percent. Thus the man-made fibers have not displaced the natural fibers (except silk) on a poundage basis; rather, their consumption has increased more rapidly than that of the natural fibers in the overall total textile fiber consumption picture, as caused not only by an increased population but also by a greater per capita consumption.

The data for the 128 end uses are grouped under the following headings: Men's and Boys' Apparel; Women's and Misses' Apparel; Children's and Infants' Apparel; Household Uses; Other Consumer-type Products; and Industrial Uses.—WHC

Crease-Resist Finishes for Cotton and Linen Fabrics

"Textile Chemist", *Textile Recorder* 71, #853, 89-91; #854, 88-90; #855, 84-6 (1954).

The usual crease-resist treatment produced with urea- or melamine-formaldehyde and an acid catalyst gives much better results on rayon than on cotton or linen. The author explains that this treatment, when applied to the natural fibers, is accompanied by a loss in tensile strength and a seriously reduced resistance to abrasion.

Although all three fibers are composed of cellulose, the physical state shows marked differences. It is generally agreed that in a viscose rayon fiber the long-chain molecules are randomly distributed, whereas in cotton and linen they are mainly aligned parallel to each other and to the longitudinal axis of the fiber.

A further point of difference is that the spacing of the cellulose molecules is closer in cotton and linen fibers than in a viscose rayon fiber. That lateral forces which hold these molecules together must also be somewhat weaker in a viscose rayon fiber is indicated by the fact that this material imbibes the largest amount of water when wetted. From these considerations it can be inferred that the rayon is more easily impregnated with an aqueous solution of the resin than either cotton or linen.

In the crease-resist process, application of the resin solution is followed by squeezing to remove excess liquor and prevent the formation of a film of resin on the fiber surface. Because of the higher absorptive power of rayon, it can be expected that there will be less excess liquor left on the outside of the rayon fibers than in the case of cotton or linen. It is possible that this difference may largely account for the adverse effect of the crease-resist process on the natural fibers, as compared with rayon.

The author describes various patented methods which have been proposed for the crease-resisting of cotton and linen with a minimum and acceptable loss of strength and wear value. Some of these processes call for a treatment with swelling agents after resinating. Some make use of other resins (e g, dicyandiamide, hydantoin, glucose ureide, etc). For details of these methods the original text should be consulted.—WHC

"Mylar" Polyester Fiber

J R Mitchell, *Textile J Australia* 29, 184, 255, April, 1954.

Du Pont's new "Mylar" polyester film can be used as a base for metallic yarn, a supporting yarn, a surfacing material for metallizing and fabric laminations, a leader material for dyeing and finishing operations, and for many other textile and nontextile applications.

According to the author, "Mylar" in metallic yarn form is made by adhering, or laminating, a wide web of the film to both sides of aluminum foil with a clear adhesive. If a yellow-orange color is added to the adhesive, a brilliant gold effect is created. Depending on the color in the adhesive, a wide variety of colors may be obtained. When these film-foil-

film laminations are then slit into very narrow widths, the result is metallic yarn.

A cotton and rayon fabric containing metallic yarn made from "Mylar" can be dyed without coloring the film.

Because of the film's high tensile strength and heat resistance, fabrics containing these metallic yarns can be laundered and ironed successfully.

When "Mylar" film is subjected to high vacuum conditions in contact with aluminum vapors, the vapors condense on the film in a very thin layer. This process, known as vacuum metallizing, results in a bright, mirror-like effect. When the aluminum-coated, or metallized, film is laminated to a fabric backing and then embossed, it creates a handsome decorative material, according to the author. The film may be colored, if desired, by printing before metallization or dyeing afterwards.

It is suggested that the "Mylar" film can be used in narrow width, heavy-gauge form as a monofilament material for special upholstery, ornamental and industrial applications; in perforated tape and card form for machine-control purposes; in pressure-sensitive tapes for use around textile plants; and as garment bags and dust covers; also for a variety of nontextile applications.—WHC

Orlon Acrylic Fiber

J L Beadle, *Textile J Australia* 29, 253-4, April, 1954.

Early this year there has been a slight modification of the composition of Orlon staple fiber from Type 41 to the new Type 42, with the principal objective of improving dyeing affinity. Orlon filament Type 81 remains unchanged.

The advantages which Type 42 staple fiber has over Type 41 are:

1) Dyeing affinity less affected by heat treatment prior to dyeing.
2) Better affinity for acid dyes at lower temperature.
3) Better lightfastness with acid dyes.
4) Wider range of acid dyes applicable at 212°F.
5) Brighter shades with acid dyes without carriers.
6) Much better lightfastness with acetate dyes.
7) Easier removal of tints.

The principal methods of dyeing Orlon Type 42 staple are:

1) Acid colors by the cuprous-ion method.
2) Basic colors at the boil.
3) Acetate colors.

The following factors need to be considered in dyeing by the cuprous-ion process:

1) The copper is only effective when in the cuprous state.
2) The rate of absorption of the cuprous ions and hence of the dyes is slow at temperatures much below 212°F.
3) The pH of the dyebath should be between 2 and 3.
4) The amount of cuprous ions absorbed is proportional to the amount in the bath, and also to the fiber:bath ratio.
5) The amount of dye absorbed is proportional to the amount of cuprous ion absorbed.

Selected basic dyes show extraordinarily good lightfastness and excellent washfastness. They are dyed at 212°F with acetic acid and sodium acetate.

Blends of Orlon 42 and wool are dyed at 210-212°F with basic colors for the Orlon and acid colors for the wool. Premetallized acid dyes are not recommended for unions.

Selected disperse acetate dyes are applied with Glauber's salt to promote exhaustion. The temperature should not be lower than 208°F.

For unions of Orlon 42 and viscose rayon the Orlon is best dyed first with acid colors by the cuprous-ion method, or with selected basic or acetate dyes. The rayon is then dyed with selected direct dyes.

Selected indigoid or thioindigoid vat dyes may be applied at temperatures up to 225°F; the bath is best buffered to pH 10 with sodium bicarbonate. The lightfastness of these dyes, however, is usually not as good as with the acid dyes applied with cuprous ions.—WHC

Resin Emulsions as Thickeners

Anon, *Dyer* 112, 203, August 6, 1954.

The idea of using a water-in-oil emulsion for textile printing pastes has been confined almost entirely to the printing of pigments, hydrocarbon solvents forming the "oil" phase and resins being dissolved in the solvent to fix the pigment to the fiber.

The conventional thickeners have been studied by textile chemists over a long period of time. At the "Symposium on Textile Printing" held at St. Annes last year, two very important papers dealt with the subject exhaustively, but only brief mention was made by one writer of water-in-oil emulsions, although they gave the most promising results.

In an emulsion thickener there are two solvents, a hydrocarbon oil and water. A pigment may be printed from an emulsion paste and may be contained either in the water phase or in the hydrocarbon solvent phase. Where the pigment is in the water phase, it has been found that a lower color value is obtained than when the same pigment is contained in the oil phase. This may possibly be due to the minute pigment particles having a greater tendency to coalesce in the water phase than in the oil phase. The result may possibly be a visual one only, since the color in the oil phase may be on the surface of the cloth and penetration may not be so deep as when the pigment is in the water phase. A new field for research is open here and one that may prove to give interesting results.

In order to give "body" to a water-in-oil emulsion it is necessary to have present about 1 or 2 percent of a resin, often of the alkyd type, dissolved in the hydrocarbon solvent, to cause the two liquids to emulsify by agitation with a high-speed stirring machine. A mayonnaise-like paste results, which is stable and will retain its viscosity for weeks. From its very nature such a paste is lubricating in its action, and practical working shows that more beautiful blotch work is produced by such pastes than by any conventional gum thickener.

So far, emulsion thickeners have not had any wide application in vat printing, but the authors suggest reasons why they should give better color yield and greater efficiency than the conventional gums. They also have advantages in printing Rapidogen colors.

Resin emulsion thickeners leave the cloth soft and supple and do not stiffen fabrics, and do not require washing out.—WHC

Peanut Protein Fiber: Ardil

P-A Koch, *Modern Textiles* 35, 46, 48, 50, August, 1954.

Ardil is a protein fiber obtained from peanuts and produced by the Imperial Chemical Industries, Ltd, of England. Details of its manufacture and chemical composition are given by the author.

The color of the fiber is a pale cream or fawn, which cannot be bleached to a white.

It has good stability to acids and alkalis in the concentrations usual in textile preparations, but is swelled and dissolved by weak alkalis at high temperatures. It can be heated to 140°C without loss in strength. It is stable to carbonization, and is not attacked by moths (by reason of its formaldehyde content).

It absorbs the usual wool dyes more rapidly and at a lower temperature than wool. It also has affinity for vat, direct, and disperse dyes.

Its principal use appears to be in blends with wool, cotton, rayon, and perhaps other fibers. When mixed with cotton and chemical fibers it gives a smooth hand and greater warmth.

The author adds that a similar fiber, called "Sarelon," has been produced experimentally by the Southern Regional Research Laboratory.

A bibliography of 54 references is included.—WHC

• NEWS OF THE TRADE •

Fred C Scholler, president of the Philadelphia Textile Institute Foundation turns spadeful of earth during ground-breaking ceremonies recently for new $500,000 150-student Residence Hall on the campus of the Philadelphia Textile Institute. Completion of the new dormitory, which will permit the Institute for the first time in its history to provide on-campus housing facilities for its international student body, is expected by Sept, 1955. Shown left to right are: Bertrand P Hayward, president of PTI; Mr Scholler; Theodore B Hayward, chairman of the building committee and a trustee; and Rinaldo A Lukens, chairman of the board.

• IPC Names Sales Representatives for Imperial Colors

Imperial Paper and Color Corp, Glens Falls, N Y, has appointed Polymer Industries Inc, Springdale, Conn, and Polymer Southern Inc, Greenville, S C, to handle sales of Imperial colors to the textile wet-processing industry.

Polymer Industries Inc, will cover New England, New York, New Jersey, Pennsylvania, Delaware and Maryland. Polymer Southern Inc, will cover Virginia, West Virginia, Tennessee, North Carolina, South Carolina, Georgia, Florida and Alabama.

• Cyanoethylated Cottons to be Known as "Azoton"

"Azoton" is the coined name the Institute of Textile Technology, Charlottesville, Va, has given to the newly developed cyanoethylated cotton textile fibers. Announcement of the new name was made by the Institute last month at the 8th National Chemical Exposition in Chicago.

The Chicago Section of the American Chemical Society selected cyanoethylation as one of the outstanding pioneering developments in chemistry during the past year. For this reason azoton was featured in the "Trail Blazers" section of new products at the Exposition.

The name azoton is derived from "azote", the French word for nitrogen, and "cotton", because the cyanoethylation process creates azoton by reacting acrylonitrile, a nitrogen-containing compound, with cotton.

• Kilborne Heads NFT Slate of Officers

R Stewart Kilborne, president, William Skinner & Sons, was elected president of The National Federation of Textiles, Inc, at the 81st annual meeting of that organization last month.

Four association vice-presidents were elected, namely — Jackson E Spears, vice-president, Burlington Mills; Edmon G Luke, vice-president, Textron, Inc; Lyman B Frieze, president, Duplan Corp; and Andrew J Sokol, vice-president, J P Stevens & Co, Inc.

Irene Blunt was re-elected secretary and treasurer.

Seven members were elected to the Board of Directors, as follows: Charles L Paine, president, Courtaulds, Inc; H B Schaeffer, vice-president, Stonecutter Mills Corp; Edward P Ix, president, Frank Ix & Sons, Inc; Lyman B Frieze; J Calhoun Harris, vice-president, Deering Milliken & Co, Inc; Edmon G Luke; and Andrew J Sokol.

• New Du Pont Lab Consolidates Several Lines of Research

Press representatives availed themselves of an opportunity last month to inspect Du Pont's new $5,000,000 textile research laboratory at Chestnut Run, Del, and to discuss with company officials the role of the new unit.

Basically, the Chestnut Run laboratory consolidates much of the work done at four of the company's older laboratories, ie, the study of the adaptability of synthetic fibers to existing mill processing equipment, the development of new machinery and techniques when the need becomes apparent, development of new end uses, customer service, etc. Two major research units — the Customer Service Section of the Sales Service Division, and the Textile and Industrial Products Research Division — are located in the new laboratory.

The laboratory is equipped for all standard processes of textile manufacturing and testing with emphasis on dyeing and finishing. Almost entirely air conditioned, the T-shaped building occupies about 100,000 sq ft of floor space. Offices and laboratories are in a two-story section approximately 282′ by 62′. Additional facilities are in a single-story section. 100 technicians and 200 additional employees comprise the staff.

Howard W Swank serves as research director for the entire program, while Linton G Ray, Jr serves as director of the new laboratory. John M Swanson is research manager for the newly formed industrial products research group currently located at Chestnut Run, and Robert W Seitz, former assistant manager of Du Pont's nylon plant at Seaford, Del, is the plant manager.

Dr Swank was chairman of a panel which answered questions submitted by press visitors. The panel consisted of W W Heckert, assistant general manager of research, Textile Fibers Dept; Dr Ray; Otto Lutness, assistant manager, customer service section; Dr D F Holmes, manager, sales development; and C H Rutledge, manager of product information.

• NSP Purchases New Site

National Starch Products Inc, New York, has purchased a tract of land at Meredosia, Illinois, for the immediate construction of a second vinyl resin plant. This plant will supplement the production of their Plainfield, N J resin plant.

The company plans to manufacture principally vinyl acetate polymers and copolymers at the new location, it is learned.

• Wide Variety of Attractions at National Chemical Show

The 8th National Chemical Exposition, held last month at the Chicago Coliseum, served as a center for a series of important chemical meetings and other activities, including joint meetings with: The Manufacturing Chemists' Association, The Chemical Market Research Association, The Society of Chemical Industry, and The Purchasing Agents' Association, all of which held technical programs.

The Manufacturing Chemists' Association presented a symposium on packaging, transportation and labelling, while The Chemical Market Research Association presented one on exposition marketing.

Other highlights included: the Industrial and Engineering Chemistry Lecture series; the meeting of the Chicago Section of the American Chemical Society, at which Walter Reppe, famous German chemist, spoke; a two-day workshop on chemical products in consumer goods, held in co-operation with the State Street Council and the Chicago Association of Retail Merchants; the Chemical Trail Blazers — an exhibit of new ideas in chemistry; Chem-Phot-Ex — an exhibit of photographs by chemists about chemistry; the Art Exhibit — an exhibit of paintings and other original works by chemists; a special program for students from the Chicago area, through the National Science Teachers' Association, with guided tours of the exposition, and a program for college seniors and graduate students on "Your Introduction to the Chemical Industry"; and the Chemical Industry Medal award dinner of the Society of Chemical Industry.

Over 34,000 square feet of balcony and exhibit floor space were allocated at the show for educational exhibits.

• Monsanto Moves Production of Several Alkyl Phosphates

Production of several alkyl phosphates has been moved to the Everett plant of Monsanto Chemical Company's Inorganic Chemicals Division.

Included in the group are ethyl acid phosphate, normal butyl acid phosphate, isopropyl acid phosphate, normal butyl acid phosphate, amyl acid phosphate, and ethyl ammonium phosphate. All of the products previously were made at Monsanto's Anniston, Ala, plant.

Production is being undertaken at the Everett plant as part of a general program for higher utilization of some of the production facilities now at the New England location. The move also will result in the manufacturing processes being located closer to consumers utilizing the products in recently developed applications.

• R&H Opens Canadian Plant

A new manufacturing plant in a suburb of Toronto has been opened by Rohm & Haas Company of Canada Limited at #2 Manse Road, West Hill, Ontario. Offices and warehouse have been moved to the same site.

• New National Aniline Branch

National Aniline Division, Allied Chemical & Dye Corporation, has opened a branch office in Los Angeles, Calif. The office, which has a complete warehouse stock, is located in Vernon, in the heart of the central manufacturing district, at 4814 Loma Vista Avenue. The telephone number is LOgan 8-2257, and the Western Union designation is National Aniline FAX, L A.

• NID Short Course

The Fourth Associate Member Short Course will be conducted by the National Institute of Drycleaning in Silver Spring, Maryland, December 5-10. A 5-day course in the high points of both the Institute's Management and General Course, it will cover drycleaning, spotting, wetcleaning, silk and wool finishing, fibers and fabrics, applied science, current garment problems, production management and business administration.

• Three Meetings of NSC's Textile Section Held in Chicago

The 42nd National Safety Congress and Exposition held in Chicago last month included three meetings of the National Safety Council's Textile Section.

At the Monday session, Oct 18, Charles L Trommer, chief of safety branch, Mohawk Carpet Mills, Amsterdam, N Y, and general chairman of the section, announced the award winners of the 1953 textile safety contest. The featured speaker was Charles Ray, vice president of Markel Service, Richmond, Va.

On Tuesday, Allen L Cobb, safety director, Eastman Kodak Co, Rochester, N Y, presented the new Eastman fire prevention motion picture, "Kodak Park Safety." Harold E Vann of General Electric Co, New York, discussed electrical safety in the textile industry.

Safety men attending the Wednesday afternoon session saw a skit on the key points of accident prevention produced by employees of the West Point Manufacturing Co, West Point, Ga. The program was under the direction of I L Murray, director of training for the company.

GENERAL CALENDAR

AMERICAN SOCIETY FOR TESTING MATERIALS
1955 Committee Week—Jan 31-Feb 4, Netherland Plaza Hotel, Cincinnati, O
1955 Annual Meeting—June 26-July 1, Chalfonte-Haddon Hall, Atlantic City, N J.

AMERICAN SOCIETY FOR QUALITY CONTROL
Annual meeting, Textile Div—Jan 27-29, Clemson College School of Textiles.

DELTA KAPPA PHI FRATERNITY
1955 Annual Convention—April 29-30, Lowell, Mass.

DEUTSCHE GESELLSCHAFT FUR CHEMISCHES APPARATEWESEN
Achema XI—May 14-22, Frankfurt am Main, Germany.

DRYSALTERS CLUB OF NEW ENGLAND
Jan 24, April 29 (Hotel Vendome, Boston, Mass); June 24 (Outing—Wachusett Country Club, W Boylston, Mass).

THE FIBER SOCIETY
Spring Meeting—May 4-5, 1955, Alabama Polytechnic Institute, Auburn, Alabama.
Fall Meeting—Sept 8-9, 1955, Massachusetts Institute of Technology, Cambridge, Mass.

INTERNATIONAL TEXTILE EXHIBITION
2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE
September, 1955—Sydney, Melbourne, and Geelong, Australia.

MANUFACTURING CHEMISTS' ASSOCIATION
4th Semi-annual meeting and Winter Conference—Nov 23, Hotel Statler, New York, N Y.

NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS, KNITTED OUTERWEAR ASSOCIATION, THE UNDERWEAR INSTITUTE
42nd Knitting Arts Exhibition—April 25-29, Convention Hall, Atlantic City, N J.

NATIONAL COTTON COUNCIL OF AMERICA
Annual Meeting—Jan 31-Feb 1, Hotel Shamrock, Houston, Tex.
Cotton Research Clinic—Feb 16-18, Pinehurst, N C.

NATIONAL INSTITUTE OF DRYCLEANING
4th Educational Conference—Dec 5-10, Silver Spring, Md.

NEW YORK PIGMENT CLUB
Dec 9, Jan 15.

PHI PSI FRATERNITY
52nd Annual Convention — April 7-9, Lowell Technological Institute, Lowell, Mass.

TEXTILE RESEARCH INSTITUTE
25th Annual Meeting—March 10-11, Hotel Commodore, New York, N Y.

NAMES IN THE NEWS

Royer

Friedman

Barnard

Schwen

Brunner

Chung

Recent personnel news from the American Cyanamid Company is highlighted by the appointment of GEORGE L ROYER as administrative assistant to the general manager of the Research Division, the retirement of KENNETH H BARNARD as technical assistant to the manager of the Textile Resin Department, and the addition of MARTIN B FRIEDMAN to the advertising and sales promotion staff of the Textile Resin Department.

Dr Royer, who was the recipient of AATCC's highest award — the Olney Medal — in 1950, will co-ordinate policies on budgets, personnel, and publications at the division's laboratories in Stamford, Conn, Pearl River, N Y, and Bound Brook, N J.

The occasion of Mr Barnard's retirement was marked by a luncheon at the King George Inn given by his fellow office and laboratory workers. Linton A Fluck, Jr, manager, Textile Resin Dept, noted that Mr Barnard was "graduating" from the third phase of his activities: 1) a successful zinc metallurgist and smelter operator, 2) chief chemist, assistant superintendent and research director for what was then the world's largest print works, and 3) technical representative for textile resins to the U S armed services for a chemical company. As a memento from the group, Mr Fluck presented Mr Barnard with a Cordovan leather brief case. Previously, at a sales group meeting at the Absecon Country Club, he had been given a drill press, completely equipped to supplement his woodworking hobby shop at Cape Cod.

Mr and Mrs Barnard are moving from Bound Brook to their permanent home at Barnstable, Mass. He will remain active as a consultant on textile finishing with Pacific Mills and the U S Dept of Commerce, and, while resigning as chairman of AATCC's National Convention Committee, he will continue to contribute to it as secretary. He also plans to remain active on the various research subcommittees of the Association in which he has been interested.

"EDWARD J MENDELL: HUMAN GUINEA PIG" was the subject of Sidney Fields' "Only Human" column in the New York Sunday Mirror *of October 3, 1954.*

Mr Mendell, proprietor of the Edward Mendell Co, New York, is member of the Walter Reed Society, a select group of 500 members who have risked their lives in medical experiments so that others might live. The story of his sacrifices in allowing himself to be exposed to the effects of mustard gas and the events leading to his decision to serve make up an extremely interesting article.

MITCHELL STEAD, formerly with the E F Houghton Company, Philadelphia, has been elected vice president of the Reading Testing Laboratories, Inc, Reading, Pa. J H QUINN, director of the Laboratories for the past eight years, has been elected president of the newly incorporated company.

On November 25th GUSTAV SCHWEN, head of the Textile Department, Badische Anilin- & Soda Fabrik A G, Ludwishafen a Rhein, Germany, will be celebrating his 60th birthday. A native of Rohrsdorf, Dr Schwen joined BASF in November, 1921, shortly after obtaining his doctor's degree. His first assignment with the firm was in the Dyestuffs Testing Department, where he occupied himself in particular with the development of new dyeing processes.

In building up the newly erected Textile Auxiliary Department, which he has headed since 1929, within the framework of the Colouristic Department of the BASF, Dr Schwen has found a fertile field of activity, in which he has been able to achieve numerous successes. This is reflected in a large number of applications for patents, scientific publications in German and foreign technical journals, and papers which he has read at meetings and congresses in several European countries.

At the end of World War II, it was necessary for the BASF to reconstruct and extend the laboratories and pilot plants of the Colouristic Department (later known as the Application Techniques Department) which had been destroyed. Dr Schwen, who was in the meantime promoted to Prokurist of the BASF, must be given credit for the successful organization and construction of the whole Textile Department, which he directed with outstanding energy and efficiency.

Apart from his activity in the BASF, Dr Schwen has been invited to co-operate on many boards and committees of international scientific and economic associations.

HORACE C BRUNNER has been named manager of the Chicago office of Wyandotte Chemicals Corporation, Michigan Alkali Division. He assumed his new duties on November 1st.

A Wyandotte employee since 1930, Mr Brunner was manager of Wyandotte's Detroit office for six years. Before being appointed assistant manager of the Chicago office for which he now assumes full responsibility, Mr Brunner served as manager of distributor sales at the Company's home office in Wyandotte, Michigan.

In his new position, Mr Brunner will be in charge of sales for one of the Michigan Alkali Division's largest territories.

WALTER N CHUNG has been appointed director of research at Peerless Color Co, Inc, Plainfield, N J.

Mr Chung has held the post of works manager and then director of research and development at the Rossville Dyestuff Corp manufacturing organic intermediates and metalized direct fast colors for textiles.

Connor

Rowland

McGraw

Poisson

Speer

Wicker

ARTHUR R CONNER, former director of the Finishing Division, Cia Textilera Ariguanabo, S A (Cuba), has joined the Rodney Hunt Machine Co, Orange, Mass, a manager of the Textile Machinery Division.

K H ROWLAND, general superintendent of the company's South Charleston plant since 1953, has been named assistant works manager of Carbide and Carbon Chemicals Co, a Division of Union Carbide and Carbon Corp. In his new capacity, Mr Rowland will make his headquarters in New York.

The appointment of RALPH O McGRAW, JR as a member of their Chicago sales staff has been announced by Onyx Oil & Chemical Company, Jersey City, N J.

For the last year and a half, Mr McGraw has been employed as a salesman with the Kraft Chemical Co of Chicago.

BRECKINRIDGE K TREMAINE, formerly associated with E I du Pont de Nemours & Co, Inc, has joined Rhodia, Inc, New York, as technical director of its Industrial "Alamask" Reodorant Division. Since April of this year, he has been on loan to Rhodia as acting technical director.

WILLIAM J MARTIN has been employed by the Federal Extension Service, U S Department of Agriculture, to serve as cotton utilization specialist. He has been with the Agricultural Marketing Service of USDA doing research on market outlets for cotton in cooperation with cotton manufacturers.

Mr Martin now has his official headquarters with the Federal Extension Service at Washington, D C but he will be transferred to Clemson College, Clemson, S C, as soon as arrangements are completed. He is assigned to the General Crops Marketing and Utilization Branch of the Division of Agricultural Economics Programs of the Federal Extension Service and will work closely with the Southern Utilization Research Branch of the Agricultural Research Service at New Orleans in conducting educational programs.

ALLEN W TAYLOR, former manager of Robbins Mills, Inc, Finishing Division, Clarkesville, Va, has been named technical sales representative for Synthron, Inc, in Virginia and North Carolina.

Tremaine

Martin

Taylor

WILLIAM H POISSON has been appointed New England representative for fiber sales and service of National Aniline Division, Allied Chemical & Dye Corp. Mr Poisson, who most recently held the position of assistant technical director of Hathaway Mfg Co, New Bedford, Mass, will make his headquarters at National Aniline's office at 15 Westminster St, Providence, R I. He will be responsible for sales and service of A-C nylon in the area.

Allied has also announced the appointment of three new section managers within the Sales Department of the Solvay Process Division. They are: R B ANTHONY, Special Alkalies Section; F P BOEHM, Ammonium & Potassium Products Section, and H R SMITH, Calcium Chloride Section. Messrs Anthony and Boehm have served the respective sections they now head as assistant manager since 1953. Mr Smith, who transferred to the Sales Department in 1941, has been performing field engineering and promotional work in connection with calcium chloride sales.

* * * *

Recipients of Allied Chemical & Dye Corporation fellowships at six educational institutions have been announced as follows:

Univ of Buffalo — LEONARD R DARBEE, majoring in organic chemistry

Univ of Illinois — GORDON R JOHNSTON, majoring in organic chemistry

Univ of Iowa — HARRY A EICK, majoring in physical chemistry

Univ of Minnesota — ROBERT S SCHECHTER, majoring in chemical engineering

Purdue Univ — DONALD F KUEMMEL, majoring in analytical chemistry

Univ of Wisconsin — WILLIAM F JOHNS, majoring in organic chemistry.

Arnold, Hoffman & Co, Inc, announced from Charlotte recently that GEORGE SPEER, JR has become a member of their technical service staff working out of the Charlotte office and laboratory.

Mr Speer brings with him a background of many years in textiles, including seventeen years with the Union Bleachery in Greenville, S C. With Arnold, Hoffman, Mr Speer will specialize in vat dyeing of piece goods and will be a member of Ahco's Southern technical demonstrating team.

The appointment of DAN B WICKER as assistant director of research in charge of physical research was announced recently by F C Huyck & Sons, Rensselaer, New York. In his new position, Dr Wicker will be concerned with the relationship between the physical properties of felts and their performance, the mechanism of water removal from the paper sheet, and other physical factors which influence felt life and operation.

Dr Wicker's most recent association before joining Huyck was with American Cyanamid Co as a leader of the synthetic fiber development group.

JOSEPH S DETWILER has been appointed export manager for Taylor Instrument Companies, Rochester, N Y, succeeding JOHN H NEUBERT, who established the department forty years ago and served continuously as its manager ever since. Mr Detwiler will be succeeded as divisional sales manager by GRANVILLE F BARNUM.

In preparation for assuming his new duties on February 1, Mr Detwiler left October 15 for a six weeks tour of South America, where he will call on sales agents and customers in eight countries.

ANDREW E BUCHANAN, JR has been named general manager of the Du Pont Company's Textile Fibers Dept, succeeding ROBERT L RICHARDS, who has stepped up to membership on the company's board of directors, a vice presidency and membership on the Executive Committee. Mr Buchanan since 1949 has been assistant general manager of the department, and he is succeeded in this post by DAVID H DAWSON, former assistant general manager in charge of manufacturing within the department.

B BARCLAY NEWLIN has joined Polymer Southern, Inc, Greenville, S C, where he will be in charge of sales, technical service and developmental work on warp sizes and other preparatory materials of the company's Textile Division.

Until recently, Mr Newlin was laboratory director for Judson Mills of Derring Milliken, Greenville, S C.

SAMUEL B McFARLANE, assistant manager, Summit Research Laboratories, Celanese Corp of America, has been invited by the Textile Research Institute of England to write the chapter on "Synthetic Polymer Fibers" in the forthcoming sixth edition of "Annual Review of Textile Progress."

Hitherto, all contributors to the review have been residents of England. Mr McFarlane is the first U E citizen to be invited to contribute to this outstanding textile review.

Volume VI of Annual Review of Textile Progress will cover the literature of 1954 and will be published in the autumn of 1955.

GERTRUDE L SPEAR, associated for more than 25 years with Progressive Color & Chemical Co Inc, and a former vice president and executive secretary, has resigned as of October 30th. Her future plans are indefinite.

R J REYNOLDS has been appointed as manager of the dyeing, printing and finishing division of Associated Textiles of Canada Limited, Louiseville, Quebec, Canada.

FREDERICK J HILL has been appointed senior process engineer, and O A BATTISTA, head of the Analytical Group, at American Viscose Corporation's Research and Development Department at Marcus Hook, Pa. Mr Hill reports to EDGAR E WREGE, who heads the operational, design and development aspects of engineering research work.

ROGER L PRUITT, a candidate for an M S in textile chemistry at North Carolina State College's School of Textiles, has been chosen to receive a newly created research fellowship, which is under the sponsorship of the Union Underwear Co, Inc and the Underwear Institute. The recipient of a scholarship established by the same concerns is C DOUGLAS BLANCHARD, a senior at the School of Textiles.

New additions to the staff of the research and development department of Hooker Electrochemical Co, Niagara Falls, N Y, include the following: EDWARD LEON, chlorination research group; JOHN J WOJNAR, analytical group; LAWRENCE E O'DONNELL, plastics and resins group; RAYMOND R HINDERSINN, chlorination research group; and WILLIAM J STRACHAN, physical chemical section of the analytical group.

Other new additions by Hooker include JAMES F LEMEN and GORDON D SARGENT, process study group, and MYRON C HALL, engineering department.

Gallowhur Chemical Corporation, New York, has announced the appointment of JOHN GERACI, former plant manager, to the position of vice president in charge of production and development, and that of SYLVAN COHEN, former chief chemist, to the position of vice president in charge of research. Both men will be located at Gallowhur's Ossining, N Y, plant.

ROBERT E MEEKER has been named sales manager of the Macbeth Corporation, Newburg, N Y, manufacturers of illumination equipment for color matching and of electronic instruments.

CORRECTION

Your attention is called to an error on page 708 of the October 11th issue. The photograph captioned "Bukaty" was not that of RAYMOND M BUKATY, newly named director of marketing on the staff of executive vice president John H Hilldring of General Aniline & Film Corp. The correct photo of Mr Bukaty appears above.

Interchemical Corp is now providing four students at Clemson College with scholarships amounting to $250 each. FRAMP HARPER, second from right, and DAVE R GENTRY, right, received aid during their junior year and also again this year. The two new recipients are shown being congratulated by Harper and Gentry as they were notified of their selection. THOMAS E BOYCE, left, and HENRY R KUEMMERER, second from left, will benefit from the scholarships this year and next year.

• NEW PRODUCTS AND DEVELOPMENTS •

• New Method for Yarn-Dyeing Helanca

A new method of yarn dyeing finished Helanca and other stretch yarns has been announced by Central Yarn and Dyeing Company, Gastonia, N C.

After exhaustive tests in the field, the company has now launched into full-scale dyeing by use of the new process, according to Herbert Girard, director of research and development.

Finished natural Helanca and other types of stretch yarn are now shipped directly to Central, either from the throwster, or from the knitter's own stock of natural yarn. The company is dyeing the finished yarn and shipping it on cones directly to the customer. Present deliveries on dyed yarn are averaging one week to 10 days in commercial production.

No details are available at present as to the method of processing; however, company officials state that customers are finding the yarn dyed under the new method to be completely satisfactory from the standpoint of residual elasticity in fabric made from the yarn.

Mr Girard stated that evaluations showing good results have been obtained on a variety of knitting equipment, including Hemphill, Bentley, and new Crawford hosiery machines.

Up until the present time, the company has been engaged in dyeing 10 turn nylon for subsequent processing into stretch yarn by the throwster. This method, which Central claims to have pioneered in the dyeing field, involves pre-twisting by the throwster to 10 turns, then dyeing, then final processing by the throwster into stretch yarn. Normal deliveries of dyed yarn to the knitters under this old process have been taking 6 to 8 weeks, and in many cases even longer.

Under the new method, in addition to the advantage of processing the dyed yarn in a week or ten days, the company claims ability to make brighter and more level colors, wider range of shades, greater resistance to crocking and bleeding, and a sharp reduction in waste, as compared to the old method. It was stated that waste is practically eliminated under the new method of dyeing.

Company officials stated that they expect their new development to create a much greater interest by knitters in making fancy stretch type hose, principally because of the short delivery period now possible on dyed stretch yarn.

• Dexter Announces New Softeners

A series of four cationic softeners, which are said to be stripped of the yellowing characteristics normally found in this type of agent, have been announced by Dexter Chemical Corp, New York.

The finishes, Dextrol Research Softener #20, #21, #22 and RDA, are said to resist yellowing both during high-temperature treatment or on long storage of the treated goods. The nonyellowing finishes are the culmination of more than three years of laboratory research, plus almost a year of actual use in several mills throughout the south and in some parts of the east, the company states.

The four finishes differ only in pH and the hand they produce on both synthetic and natural fibers. The agents, according to Dexter, exhibit high antistatic characteristics and resist drycleaning and washing to a moderate degree. It is said that the softeners are compatible with most resin mixes as well as with starch, dextrins, gums and similar substances.

These products can be applied in either the final rinse after dyeing or by padding. One-half to three percent on the weight of the goods in a bath or a similar amount on the weight of the pad liquor is claimed to produce excellent hand in cotton, rayon, acetate, wool, nylon, Dacron, Orlon and other synthetic fibers.

• Agilon Stretch Yarn

Unusual versatility and a wide range of applications to knitted garments and fabrics, and to woven fabrics as well, are two of the primary advantages claimed for a new elastic nylon filament yarn shown last month by the Deering Milliken Research Trust at the Greenville textile show.

The new stretch yarn, introduced under the trade-mark, Agilon, is now in commercial production for use in women's and men's hosiery and undergarments, and in woven and tricot fabrics.

Among the properties of the new yarn as enumerated by Deering Milliken officials, special emphasis was placed on its softness and silky hand. It is claimed that stockings made of the new yarn may be washed with the same ease as regular nylon stockings and that they also dry quickly. On the question of dyeing it is stated that the new yarn has the same affinity for dyestuffs as regular nylon filament yarn. Smooth surface, superior uniformity and proper elasticity are other characteristics that are said to assure great ease of manipulation and high speed in all steps of fabrication.

Applications for patents covering the new yarn, its method of manufacture and apparatus involved, have been filed. Duplan Corporation and Judson Mills are now licensed to manufacture this yarn, and other companies complying with the required standards will be licensed.

• Fiberglas Color Tubs

Color tubs in a range of stock sizes for the textile industry are now molded in fiberglas by Beetle Products Division of Beetle Boat Co, Inc, Grinnell St, New Bedford, Mass.

Beetle Tubs are said to be lighter in weight and less expensive than stainless steel, and in contrast with wooden tubs, are readily washed out. Although lightweight, they reportedly have high resistance to impact and will withstand extensive wear and tear.

Tubs in the new Beetle line reportedly are noncorrosive, nontoxic, and electrically nonconductive. Smooth-surfaced inside and out for easy cleaning, they are said to be capable of withstanding temperatures well above boiling point. Colors are permanently impregnated in the material.

• Vinyl Sponge

The Watson-Standard Company, 225 Galveston Ave, Pittsburgh 12, Pa, recently announced a new vinyl sponge plastisol of particular interest to the textile industry as rug padding or underlays, as a laminate, etc.

This new compound, furnished as a pourable liquid, is said to expand on curing at 350 to 400°F to a uniform vinyl sponge coating. It is stated that normal coating and curing equipment, such as used in applying other vinyl types dispersions, can be used satisfactorily. A chemical blowing agent incorporated into a vinyl plastisol causes expansion at atmospheric pressures. The compound reportedly may be modified to various densities, tear strength, elongations, and chemical resistance for various end uses, a film may be cured and rolled and then later expanded by the application of additional heat.

It is claimed that these compounds will not rot nor stain, are virtually odorless, are scuff resistant, perspiration resistant and will not harden with age. They are said to be resistant to fading and can be manufactured in any color and with a leather-like finish if desired.

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